Myren Consulting, Inc.

United States
Environmental Protection Agency
Woodheater Certification Program
Woodheater Certification Test Report

Kuma Stove and Iron Works
Kuma Wood Classic
Model HT-2
Noncatalytic Wood Stove

September 30, 1999

Myren Consulting, Inc.

Office:
512 Williams Lake Road
Colville, WA 99114
(509)684-1154
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Laboratory:
501-C Williams Lake Road
Colville, WA 99114
(509)685-9458

* * * * * * *

CONFIDENTIAL

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The data and information in this test report is confidential, proprietary information and is not to be released to and/or discussed with any party who is not authorized by the manufacturer or the testing laboratory to receive such data.

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CONFIDENTIAL

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REPORT CERTIFICATION

The sampling and analysis for the woodstove described in this report was carried out under my direction and supervision.

Date 9/30/99 Signature Albert V. Myers Jr.

Date _____ Signature _____

I have reviewed all of the testing data and results found in this test report and hereby certify that the test report is authentic and accurate.

Date 9/30/99 Signature Albert V. Myers Jr.

Field Observation Checklist

Unit Name: Kuma Wood Classic Date: 9/30/99

Manufacturer Name: Kuma Stove and Iron Works

Manufacturer Address: 450 Old Highway 95
Rathdrum, ID 83858

Manufacturer Phone: 208 762 8002 Fax: 208 762 5862

Observers & Affiliation:

Myren Consulting's Field Team:

Supervisor: Ben Myren John Palm

Other Members: Ron Schenck Ilse Myren
Orion Myren Thyen Myren

Test Location: 501-C Williams Lake Road, Colville, WA 99114
(509)685-9458

Test Site Elevation: 1645 Feet

Lab:
501-C Williams Lake Road
Colville, WA 99114
(509)685-9458

Office:
512 Williams Lake Road
Colville, WA 99114
(509)684-1154
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STATEMENT OF CONFIDENTIALITY

As a condition of being allowed to visit the woodstove testing facility and/or observe a woodstove test(s) at Myren Consulting, Inc.'s testing laboratory located at Suite 106, 12810 NE 178th St., Woodinville, WA 98072, I hereby agree not to release or divulge any information about the design engineering principals used at Myren Consulting, the testing facility, the testing personnel or the testing procedures (other than the information found in the Standard Method for Measuring the Emissions and Efficiencies of Residential Woodstoves promulgated by the Oregon Department of Environmental Quality (DEQ) and/or Methods 28, 28A, 5G and 5H promulgated by the United States Environmental Protection Agency (EPA) to any other individual or firm unless specifically authorized to do so by an authorized person from Myren Consulting.

SIGNED: _____	SIGNED: _____
Name	Name
_____	_____
Title	Title
_____	_____
Affiliation	Affiliation
_____	_____
Date	Date

Test Series Information and Discussion

Unit: Kuma Wood Classic Noncatalytic Woodstove

Model #: HT-2

Manufacturer: Kuma Stove and Iron Works

Date Received: 9/8/99 Date(s) Aged: 9/8 & 9/99

Test Dates: 9/11, 13, 14, 15, 16, 17 and 18/1999

Sampling Methods Used: M28, 5G-1 Number of Test Runs: 7

The Kuma Wood Classic Noncatalytic Wood Stove manufactured by Kuma Stove and Iron Works of Rathdrum, ID was tested by Myren Consulting, Inc. using the United States Environmental Protection Agency's (EPA) Method 28, "Certification and Auditing of Wood Heaters", Method 5G-1 "Determination of Particulate Emissions from Wood Heaters from a Dilution Tunnel Location." And, if applicable, Method 28A, "Measurement of Air to Fuel Ratio and Minimum Achievable Burn Rates for Wood Fired Appliances". (See the Federal Register/ Vol. 53, No. 38/ Friday, February 26, 1988/ pp. 5860-5926.) The Particulate Matter (PM) emission data, if present, was calculated as specified in the Wood Heater New Source Performance Standard (NSPS).

If computed and reported, Oregon Overall Efficiency (%OE) for each run was calculated using the computer program supplied by the State of Oregon's Department of Environmental Quality (DEQ) as part of the "Standard Method for Measuring the Emissions and Efficiency of Residential Woodstoves". The weighted average overall efficiency was calculated using the overall efficiency data for each run and the EPA Burn Rate Probabilities for calculating weighted averages.

All events pertinent to the test data and test results are recorded on the data sheets in the individual test runs, particularly on pp. 9, 9A, 9A-1 and 12.

Any deviations made or noted from the promulgated methods other than those which were accepted and certified by the EPA and/or the DEQ during the laboratory accreditation process are listed and discussed below.

A brief note about how the particulate samples were processed is necessary to help the reviewer understand the net catch values. Experience has shown that the small portions of the filters left on the frits in the M5G-1 filter housing apparatus are full of static electricity and when these small portions are removed to a plastic petri dish, they quickly adhere to the dish. Trying to recapture this material during weighing causes it to disintegrate into smaller and smaller pieces, making obtaining accurate catch weights difficult. Thus, it was decided to place this material in with the particulate captured with the acetone wash, where it shows up as catch. Some of the filter material was already following this pathway. Thus, there may be negative filter weight catches, particularly for the back half filter, that are used during the particulate emission rate calculation process. However, the filter material lost off the filters is accounted for in the acetone catch.

The following pages contain (1) a diagram showing the height and location of the stack components and sampling ports, (2) a diagram of the EPA M5G-1 dilution tunnel components in Myren Consulting Inc.'s laboratory, (3) copy(s) of the certification test notifications sent to EPA for the week(s) the unit was tested and (4) a discussion of test results.

Seven(7) test runs were conducted on the unit during the certification test series. The reasons for the three(3) additional runs are as follows:

1. Run 3, a medium high, broke Delta T and had to be repeated.
2. Run 5 is the Fan Confirmation Test (FCT).
3. Run 7 is an additional High burn. During the first high burn (Run 6), the wood fell and partially blocked the air flow from the Lower Primary Air Orifice (LPAO). This reduced the dry burn rate (DBR) and thus the heat or BTU/hr output. The manufacturer then elected to do an additional high burn and try for a higher DBR and heat output, which is what happened in Run 7.

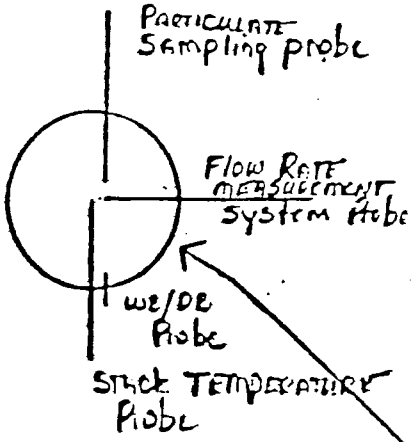
While the fan confirmation test's emissions are higher than either the medium low or the medium high, they are within EPA's +1.0 g/hr spec based upon the weighted average for the two runs. The weighted average of the medium low and the medium high is 3.954 g/hr.

The Kuma Wood Classic because it is loaded end to end or north-south has a tendency to have "bad" wood falls. When this happens the air flow from the LPAO is either partially or completely blocked for a period of time. When this happens during a test, the result is a much lower DBR than expected and/or breaking the Delta T limit of $\pm$ 125° F. Since this normally happens after the wood has reached

the charcoal stage, the impact on emissions is minimal. What the consumer will notice is a longer DBR. What a stove tester sees is problems due to test requirements. Thus the "bad" in quotation marks. As noted above, Runs 3 and 6 both had wood falls that impacted test results in such a way as to require the run to be repeated. Run 2 also had a wood fall that resulted in a longer than expected test, but the run did not exceed the Delta T limit, so it is acceptable as far as EPA is concerned.

Stack Ht. 186.75" 15.48'
15.0 ± 1 ft. (M2B, 4.1.1)

Top View Detail



Stack Measurements And Sampling Port Locations

SO_2 Sampling Probe Ht N/A
13.5 ft. ± 0.5 ft (M5H, 5.1.5.2)

Steel Flue Pipe Ht 106.5"
8.5 ± 0.5 ft (M2B, 4.1.1) 8.875'

SO_2 Injection Probe Ht. N/A
9.5 ft ± 0.5 ft (M5H, 5.1.5.1)

100.75" = 8.40'
Wet Bulb/Dry Bulb Probe Ht
(No Specification given)

Particulate Sampling Probe
Ht. N/A 8.0 ± 0.5 ft (M5H, 5.1.2)

Stack Temperature Probe Ht.
8.5 ± 0.5 ft (DEQ, 3.2.1)
107.375" = 8.95'

Flow Rate Measurement System Probe
Ht. 100" 7.5 ± 1.0 ft (M5H, 5.1.6)
8.33'

Cutaway Detail on Barometric Oil Seal

Static Pressure Probe Ht 7"
< 1.0 ft above flue connector (M2E, 6.2.3)

Stove Ht at the flue collar 34"

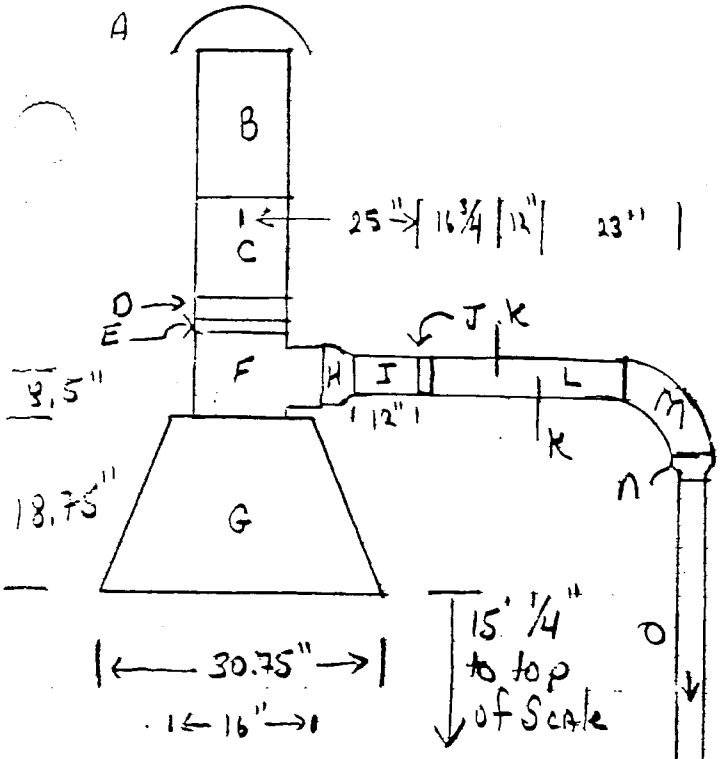
Platform Scale

Unit Kuma Wood Classic
Date 9/11/99
Technician A.T. Myren

MYREN CONSULTING INC

Dilution Tunnel Skematic

9/9/97



A: Class A Rain Cap
B: 36" of 10" ID Class A Chimney
C: 18" of 10" ID " " "
Class A
E: 10" Self Cleaning Full Closure
Blast Gate
F: 10" 22ga Black Steel Pipe "T"
G: Dilution Tunnel Hood
H: 10" to 8" Black Steel Pipe Reducer
I: 12" of 8" Black Steel Pipe
J 8" Self Cleaning Full Closure
Blast Gate
K: Mixing Baffles
L: 51¾" of 8" Black Steel Pipe
M: 8" 90° Black Steel Pipe Elbow
N: 8" to 6" Black Steel Pipe Reducer
O: 194½" of Black Steel Pipe
P: 6" Black Steel Pipe T Section
Q: 6" Self Cleaning Full Closure
Blast Gate (for adjusting flows)
R: 100⅞" 6" Black Steel Pipe
S: 2¼" diameter Bleed Hole
T: Dayton Blower
U: 6" Black Steel Pipe (Exhaust)

NOT to SCALE

Dimensions Shown are actual

TOTAL TUNNEL Length - 22.635'
Hood Entrance to Sampling Port

Myren Consulting, Inc.
512 Williams Lake Road
Colville, WA 99114

Date: 7/29/99
Faxed: 7/29/99

Mr. Robert Marshall
Woodheater Certification Program
Manufacturing, Energy and Transportation Division (223A)
Office of Compliance, U.S. EPA
1200 Pennsylvania Ave. NW
Washington, D.C. 20044

Dear Mr. Marshall:

RE: WOODHEATER CERTIFICATION TEST NOTIFICATION

This letter is to notify EPA that

Name: Kuma Stove and Iron Works

Address: 450 Old Highway 95, Sandpoint, ID 83858

Contact Person: Mark Freeman

Phone: 208 762 9002 has scheduled X or canceled _____ the

Unit Name: Kuma Model #: Wood Classic

for certification testing at Myren Consulting's lab starting on

9/6/99 and ending on about 9/12/99 or

has scheduled additional runs on the above unit starting on

_____ and ending on _____.

NOTE: If this is a cancellation notice, the cancellation is for the notification dated

_____ and is only for the dates shown. All other current notifications

are still in effect. The next scheduled test period for this unit is _____.

Sincerely,

Ben

Ben Myren

Form001

Myren Consulting, Inc.
512 Williams Lake Road
Colville, WA 99114

Date: 7/29/99

Faxed: 7/29/99

Mr. Robert Marshall
Woodheater Certification Program
Manufacturing, Energy and Transportation Division (223A)
Office of Compliance, U.S. EPA
1200 Pennsylvania Ave. NW
Washington, D.C. 20044

Dear Mr. Marshall:

RE: WOODHEATER CERTIFICATION TEST NOTIFICATION

This letter is to notify EPA that

Name: Kuma Stove and Iron Works

Address: 450 Old Highway 95, Sandpoint, ID 83858

Contact Person: Mark Freeman

Phone: 208 762 9002 has scheduled X or canceled _____ the

Unit Name: Kuma Model #: Wood Classic

for certification testing at Myren Consulting's lab starting on

9/13/99 and ending on about 9/19/99 or

has scheduled additional runs on the above unit starting on

_____ and ending on _____.

NOTE: If this is a cancellation notice, the cancellation is for the notification dated

_____ and is only for the dates shown. All other current notifications

are still in effect. The next scheduled test period for this unit is _____.

Sincerely,

Ben

Ben Myren

Form001

EPA WEIGHTED AVERAGES CALCULATIONS
EPA WEIGHTED AVERAGE PARTICULATE EMISSION RATE

The weighted average particulate emission rate ($\overline{PM}$) for the Kuma Wood Classic Noncatalytic Wood Stove manufactured by Kuma Stove and Iron Works is 3.3 g/hr.

EPA WEIGHTED AVERAGE OVERALL EFFICIENCY

The weighted average overall efficiency ($\overline{OE}$) for the Kuma Wood Classic is (default) 63 %.

II. EPA TEST RESULTS
* Denotes runs used in weighted average calculations

Run #	Dry Burn Rate/kg/hr	Grams/Hour	Overall Efficiency
1	0.934	3.606	
2	1.007	2.876	
4	1.678	3.059	
6	3.017	3.689	
7	3.982	12.332	
5[1]	1.213	3.720	
3[2]	1.260	1.930	

Notes: 1. Run 5 = Fan Confirmation Test
2. Run 3 broke Delta J.

III. EPA CUMULATIVE PROBABILITY CALCULATIONS

$$P_n = \frac{[\text{Hi Prob.} - \text{Low Prob.}][\text{Act. Dry Burn Rate} - \text{Low Dry Burn Rate}]}{.05} + \text{Low Prob.} = P_n$$

$P_1 = \frac{[\ .328 - .300\ ][\ .934 - .900\ ]}{.05} + .300 = .3190$

$P_2 = \frac{[\ .407 - .380\ ][\ 1.007 - 1.000\ ]}{.05} + .380 = .3838$

$P_3 = \frac{[\ .840 - .825\ ][\ 1.678 - 1.650\ ]}{.05} + .825 = .8334$

$P_4 = \frac{[\ .985 - .984\ ][\ 3.017 - 3.000\ ]}{.05} + .984 = .9843$

$P_5 = \frac{[\ .994 - .994\ ][\ 3.982 - 3.950\ ]}{.05} + .994 = .9940$

$P_6 = \frac{[\ \ - \ \ ][\ \ - \ \ ]}{.05} + \_\_\_\_ = \_\_\_\_$

$P_7 = \frac{[\ \ - \ \ ][\ \ - \ \ ]}{.05} + \_\_\_\_ = \_\_\_\_$

$P_8 = \frac{[\ \ - \ \ ][\ \ - \ \ ]}{.05} + \_\_\_\_ = \_\_\_\_$

$P_9 = \frac{[\ \ - \ \ ][\ \ - \ \ ]}{.05} + \_\_\_\_ = \_\_\_\_$

$P_{10} = \frac{[\ \ - \ \ ][\ \ - \ \ ]}{.05} + \_\_\_\_ = \_\_\_\_$

$P_{11} = \frac{[\ \ - \ \ ][\ \ - \ \ ]}{.05} + \_\_\_\_ = \_\_\_\_$

$P_{12} = \frac{[\ \ - \ \ ][\ \ - \ \ ]}{.05} + \_\_\_\_ = \_\_\_\_$

$P_{13} = \frac{[\ \ - \ \ ][\ \ - \ \ ]}{.05} + \_\_\_\_ = \_\_\_\_$

$P_{14} = \frac{[\ \ - \ \ ][\ \ - \ \ ]}{.05} + \_\_\_\_ = \_\_\_\_$

$P_{15} = \frac{[\ \ - \ \ ][\ \ - \ \ ]}{.05} + \_\_\_\_ = \_\_\_\_$

$K_1 = P_2 - P_0 =$	.3838	- .000	=	.3838
$K_2 = P_3 - P_1 =$	.8334	- .3190	=	.5144
$K_3 = P_4 - P_2 =$	.9643	- .3838	=	.6005
$K_4 = P_5 - P_3 =$	.9940	- .8334	=	.1606
$K_5 = P_6 - P_4 =$	1.0000	- .9843	=	.0157
$K_6 = P_7 - P_5 =$		-	=	
$K_7 = P_8 - P_6 =$		-	=	
$K_8 = P_9 - P_7 =$		-	=	
$K_9 = P_{10} - P_8 =$		-	=	
$K_{10} = P_{11} - P_9 =$		-	=	
$K_{11} = P_{12} - P_{10} =$		-	=	
$K_{12} = P_{13} - P_{11} =$		-	=	
$K_{13} = P_{14} - P_{12} =$		-	=	
$K_{14} = P_{15} - P_{13} =$		-	=	
$K_{15} = P_{16} - P_{14} =$		-	=	

IV. EPA WEIGHTED AVERAGES CALCULATIONS

The following formula is the one set out in Equation 28-1, Section 8.1, Method 28 and is to be used to calculate both the weighted average particulate emission rate (PM) and the weighted average overall efficiency (OE) as shown below. The formula uses interpolated probabilities for a given heat output demand calculated from the values listed in Table 28-1(2) in Method 28.

$$\overline{PM} = \frac{K_1PM_1 + K_2PM_2 + K_3PM_3 + \ldots K_nPM_n}{K_1 + K_2 + K_3 \ldots + K_n}$$

Where $\overline{PM}$ = The EPA weighted average particulate matter (PM) emission rate in grams per hour (g/hr).
$K_1, K_2, K_3, \ldots K_n$ = The weighting factors for the individual test runs as determined in III above.
$PM_1, PM_2, PM_3, \ldots PM_n$ = The particulate emission rates for the individual test runs as listed in II above.

And

$$\overline{OE} = \frac{K_1OE_1 + K_2OE_2 + K_3OE_3 + \ldots K_nOE_n}{K_1 + K_2 + K_3 + \ldots K_n}$$

Where $\overline{OE}$ = The EPA weighted average overall efficiency in percent (%).
$K_1, K_2, K_3, \ldots K_n$ = The weighting factors for the individual runs as determined in III above.
$OE_1, OE_2, OE_3, \ldots OE_n$ = The overall efficiencies for the individual test runs as listed in II above.

IV.A. EPA WEIGHTED AVERAGE PARTICULATE EMISSIONS CALCULATIONS

$$\overline{PM} = \frac{.3838(3.606) + .5144(2.876) + .6005(3.059) + .1606(3.689) + .0157(12.332) + (\quad) + (\quad)}{.3838 + .5144 + .6005 + .1606 + .0157 + \quad + \quad}$$

$$\frac{(\quad) + (\quad) + (\quad) + (\quad) + (\quad) + (\quad) + (\quad)}{\quad + \quad + \quad + \quad + \quad + \quad} =$$

$$\overline{PM} = \frac{1.3840 + 1.4794 + 1.8369 + .5925 + .1936 + \quad + \quad + \quad + \quad + \quad + \quad + \quad + \quad}{1.6750} =$$

$$\overline{PM} = \frac{5.4864}{1.6750} = 3.2755 = 3.28 \text{ g/hr} \approx 3.3 \text{ g/hr}$$

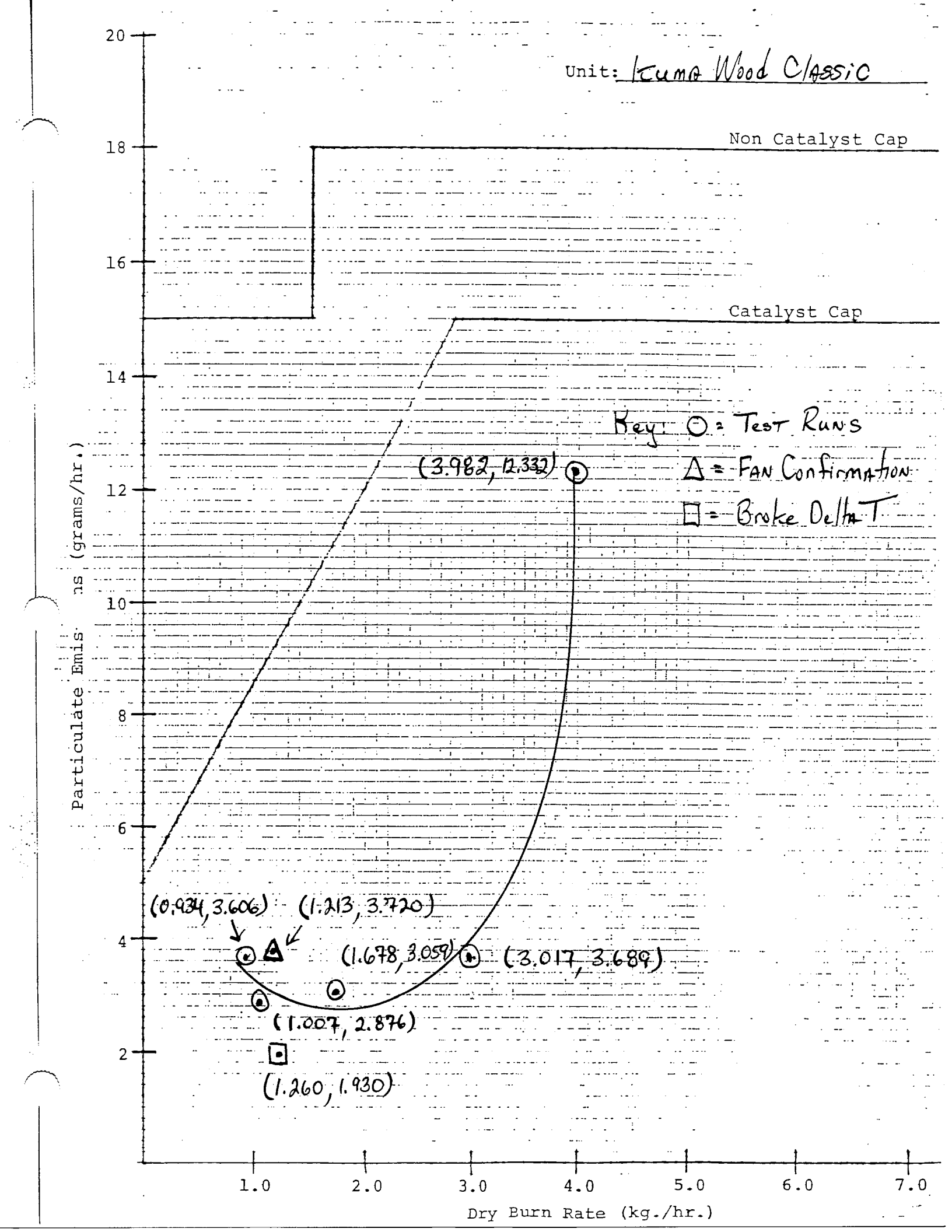
IV.B. EPA WEIGHTED AVERAGE OVERALL EFFICIENCY CALCULATIONS

$$\overline{OE} = \frac{(\quad) + (\quad) + (\quad) + (\quad) + (\quad) + (\quad) + (\quad)}{\quad + \quad + \quad + \quad + \quad + \quad + \quad}$$

$$\frac{(\quad) + (\quad) + (\quad) + (\quad) + (\quad) + (\quad) + (\quad)}{\quad + \quad + \quad + \quad + \quad + \quad} =$$

$$\overline{OE} = \frac{\quad + \quad + \quad + \quad + \quad + \quad + \quad + \quad + \quad + \quad + \quad + \quad + \quad}{\quad} =$$

$$\overline{OE} = \frac{\quad}{\quad} = \underline{\quad} = \underline{\quad}\ \%$$


Unit: Kuma Wood Classic
Non Catalyst Cap
Catalyst Cap
Key: ○ = Test Runs
△ = Fan Confirmation
□ = Brake Delta T
(3.982, 12.332)
(0.934, 3.606)
(1.213, 3.720)
(1.678, 3.059)
(3.017, 3.689)
(1.007, 2.876)
(1.260, 1.930)
Particulate Emissions (grams/hr.)
Dry Burn Rate (kg./hr.)
20
18
16
14
12
10
8
6
4
2
1.0
2.0
3.0
4.0
5.0
6.0
7.0

Unit: Kuma Wood Classic

WST2-Form12

Woodstove Data Summary

Run #	1	2	4	6	7		5[1]	3[2]	
Particulate Emissions:									
Concentration: grains/dscf:									
grams/m^3:									
Emission Rate: grams/hr:	3.606	2.876	3.059	3.689	12.332		3.720	1.930	
Emission Factor: gms/kg: (dry fuel weight basis)									
Front Half Catch: % of total									%
Total Mass Captured: Frt & Bck Halves:	47.9	33.9	21.1	15.2	49.6		37.9	16.1	mg
Efficiency Valves:									
Overall Appliance Efficiency									%
Combustion Efficiency									%
Heat Transfer Efficiency									%
Heat Output:									
~~EPA~~ Avg. BTU/hr for test cycle	11,265	12,143	20,232	36,385	48,012		14,630	15,188	BTU/hr
Fuel Burn Rates:									
Avg Kg/hr for test cycle (Wet basis)	1.135	1.223	2.038	3.670	4.846		1.472	1.528	Kg/hr
Avg Kg/hr for test cycle (Dry basis)	0.934	1.007	1.678	3.017	3.982		1.213	1.260	Kg/hr

Notes: 1. Run 5 = Fan Confirmation Test.
2. Run 3 broke Delta T.

	RUN #	1	2	4	6	7		5	3	
Fuel Moisture Content:										
Kindling (Wet basis)		11.608	11.478	11.479	10.634	18.094		11.479	11.478	%
Pretest Fuel (Wet basis)		17.565	17.372	18.195	17.321	17.628		17.848	18.594	%
Test Fuel (Wet basis)		17.714	17.632	17.660	17.790	17.831		17.555	17.582	%
Air/Fuel Ratio:										
lbs air/lbs fuel										
Average Stack Gas Composition:										
Avg. % CO_2										%
Avg. % O_2										%
Avg. % CO										%
Avg. % Excess Air										%
Avg. % Moisture										%
Average Stack Gas Flow Rate:										
Stack flow rate -	EPA CMB									dscfm
	CHO balance									dscfm
	Tracer Gas									dscfm
Draft (Static)		-.0356	-.038	-.054	-0.077	-.0792		-.045	-.047	in.H_2O
Proportionality - Average		99.97	100.02	100.15	100.04	100.18		100.02	98.98	%
Average Stack Gas Emission Factors:										
CO - g/Kg										
g/hr										

RUN #	1	2	4	6	7		5	3	
Average Temperatures:									
Stack Gas	255	269	356	556	587		299	276	°F
Primary Combustion Chamber Gas	734	778	887	1037	1011		818	815	°F
Secondary Combustion Chamber Gas	936	939	1090	1257	1323		1006	1000	°F
Catalytic Combustor Exit Gas	N/A	N/A	N/A	N/A	N/A		N/A	N/A	°F
Stove Top	377	399	492	655	707		432	448	°F
Stove Left Sidewall	434	459	532	672	710		480	512	°F
Stove Back	267	261	298	375	422		339	283	°F
Stove Right Sidewall	431	433	510	644	681		461	466	°F
Stove Bottom	377	391	434	452	458		417	397	°F
Stove Temperature Change	-114.0	-109.0	-59.4	-32.8	+20.8		-58.8	-135.8	°F
Test Chamber Environment:									
Avg. Barometric Pressure	28.766	28.721	28.498	28.640	28.613		28.480	28.607	in Hg
Avg. Temperature	76	76	77	69	71		76	82	°F
Avg. % Ambient Moisture	1.325	1.50	1.675	1.725	1.50		1.60	1.80	% H_2O
Avg. % Relative Humidity	41.5	50.0	48.0	56.5	48.0		52.5	52.5	%RH
Avg. Air Velocity	00.0	00.0	00.0	00.0	00.0		00.0	00.0	m/sec
Avg. Dilution Tunnel Draft (If Applicable)	00.0	00.0	00.0	00.0	00.0		00.0	00.0	in/H_2O
Test Fuel Weight and Burn Time:									
Density (Dry basis)	.4214	.4385	.4999	.5256	.4162		.5231	.4625	gm/cm^3
Coal Bed Weight	3.2	3.6	3.6	3.0	3.4		3.2	3.4	lbs.
Pre Test Fuel Wt (Inc Kindling)	46.5	47.2	47.0	53.4	52.6		47.0	47.9	lbs.
Test Fuel Load Weight	14.6	14.6	14.6	14.7	14.6		14.6	14.6	lbs.
Total Test Cycle Burn Time	350	325	195	109	82		270	260	min.

Unit Kuma Wood Classic
Date 9/8 AND 9/99
Technicians A.T.M, RLS
Page 1 of 1
WST5-Form3

CATALYTIC COMBUSTOR AGING DATA
OR
STOVE AGING DATA
WOODSTOVE TEST DATA SHEET #25

		T/C#	9	10			
Hr. #	Date	Time	Firebox Temp	Secondary Burn Temp	Post Cat	In Cat	Comments
1	9/8/99	1025	995	1559			Fire Started 0802
2	↓	1125	896	1023			
3		1225	722	1395			
4		1325	882	1242			
5		1425	783	843			
6		1525	682	726			
7		1625	642	683			
8	↓	1725	591	616			
9	9/9/99	1020	960	1460			Fire Started 0756
10	↓	1120	965	901			
11	↓	1220	743	1210			

Kuma EPA 1

DILUTION TUNNEL CALCULATIONS — MYREN CONSULTING CERTIFICATION TEST DATA

3/31/96

File Name:	KumaEPA 1
Stove Manufacturer:	Kuma
Model Number:	Wood Classic
Lab Name:	MYREN
Test Date:	9\11\99
Run Number:	EPA 1
Meter Box Y Factor:	1.0151
Barometric pressure (in):	28.766
Gas meter temp (ave):	88
delta H(avg):	0.900
Gas meter initial reading:	355.700
Gas meter final reading:	550.492
Front catch (acetone) mg:	8.6
first filter catch (mg):	38.6
second filter catch (mg):	0.7
tunnel flow (ave cfm):	143.403
Emission Rate(g/hr):	2.279
Emission Rate(M5H) :	3.606
vs/VmTs:	0.0082
vs ave:	837.179
Tunnel average temp (°f):	98.250
Test time(min):	350
Fuel Load(lb. wet):	14.6
Wood moisture(%wet):	17.714
Burn rate(dry kg/hr):	0.934
Samp vol(scf):	183.510
front filter number	824
back filter number	823
acetone beaker number	24
PRELIMINARY RESULTS	
FINAL RESULTS	AUDITED
DATA SUMMARY	
MODEL :	Wood Classic
RUN:	EPA 1
DATE:	9\11\99
DBR:	0.934
GPH UNADJ	2.279
ADJ	3.605646784

RUN TIME (min)	PITOT DELTAP (- INCH H20)	TNL TEMP (°F)	GAS METER RDG (ft3)	GAS METER TEMP (°F)	GAS METER DELTA H (in.H2O)	TUNNEL VELOCIT (ft/min)	PROP RATE (%)	dDGM vol std (ft3)
0	0.040	97	355.700	80	0.900	836.26		
10	0.040	107	361.269	80	0.900	843.73	103.3	5.324
20	0.040	104	366.849	82	0.900	841.50	101.6	5.315
30	0.040	106	372.410	83	0.900	842.99	101.7	5.287
40	0.040	108	377.967	84	0.900	844.48	101.6	5.274
50	0.040	109	383.498	86	0.900	845.22	100.8	5.230
60	0.040	110	389.068	87	0.900	845.96	101.4	5.257
70	0.040	110	394.620	87	0.900	845.96	101.0	5.240
80	0.040	110	400.189	87	0.900	845.96	101.3	5.256
90	0.040	108	405.755	87	0.900	844.48	100.9	5.253
100	0.040	106	411.333	88	0.900	842.99	100.7	5.255
110	0.040	104	416.910	88	0.900	841.50	100.5	5.254
120	0.040	102	422.482	88	0.900	840.00	100.3	5.249
130	0.040	101	428.059	89	0.900	839.26	100.2	5.245
140	0.040	100	433.624	89	0.900	838.51	99.9	5.233
150	0.040	99	439.208	89	0.900	837.76	100.1	5.251
160	0.040	98	444.792	89	0.900	837.01	100.0	5.251
170	0.040	98	450.368	89	0.900	837.01	100.0	5.244
180	0.040	97	455.950	89	0.900	836.26	99.9	5.249
190	0.040	97	461.528	90	0.900	836.26	99.7	5.236
200	0.040	96	467.102	90	0.900	835.51	99.5	5.232
210	0.040	96	472.675	90	0.900	835.51	99.6	5.231
220	0.040	95	478.250	90	0.900	834.76	99.4	5.233
230	0.040	95	483.812	90	0.900	834.76	99.3	5.221
240	0.040	94	489.383	90	0.900	834.00	99.3	5.229
250	0.040	94	494.965	90	0.900	834.00	99.6	5.240
260	0.040	94	500.552	91	0.900	834.00	99.5	5.235
270	0.040	93	506.113	91	0.900	833.25	98.8	5.211
280	0.040	92	511.663	90	0.900	832.50	98.7	5.210
290	0.040	90	517.220	90	0.900	830.99	98.6	5.216
300	0.040	89	522.765	89	0.900	830.23	98.5	5.215
310	0.040	90	528.405	89	0.900	830.99	100.5	5.304
320	0.040	88	533.875	88	0.900	829.47	97.2	5.153
330	0.040	87	539.419	87	0.900	828.72	98.7	5.233
340	0.040	87	544.975	88	0.900	828.72	98.8	5.234
350	0.040	86	550.492	87	0.900	827.96	98.1	5.207

METHOD 5G-1 PARTICULATE SAMPLING DATA Kuma LAB-

DATE 9/11/1999 PAGE 1 OF 2 MODEL # Wood Classic RUN # EPA 1

METER BOX # 511-M METER Y 1.0151 FILTER # (F) 824 (R) 823

PRE TEST LEAK RATE = .000 CFM @ -16.25 IN. HG .357/.357 FILTER SIZE: 110 mm

POST TEST LEAK RATE = .000 CFM @ -12.00 IN. HG .526/.526 PROBE LENGTH 24" glass

TIME		METER READING CU.FT.	PITOT dp	TNL TEMP. (°F)	METER TEMP. (°F)	GAS METER dh	VAC IN. Hg
CLOCK	ELAPSED						
1316	00	355,700	.040	97	80	0.90	0
20	10	361.269	.040	107	80	.90	0
30	20	366.849	.040	104	82	.90	0
40	30	372.410	.040	106	83	.90	0
50	40	377.967	.040	108	84	.90	0
1400	50	383.498	.040	109	86	.90	0
10	60	389.068	.040	110	87	.90	0
20	70	394.620	.040	110	87	.90	0
30	80	400.189	.040	110	87	.90	0
40	90	405.755	.040	108	87	.90	0
50	100	411.333	.040	106	88	.90	0
1500	10	416.910	.040	104	88	.90	0
10	20	422.482	.040	102	88	.90	0
20	30	428.059	.040	101	89	.90	0
30	40	433.624	.040	100	89	.90	0
40	50	439.208	.040	99	89	.90	0
50	60	444.792	.040	98	89	.90	0
1600	70	450.368	.040	98	89	.90	0
10	80	455.950	.040	97	89	.90	0
20	90	461.528	.040	97	90	.90	0

F R

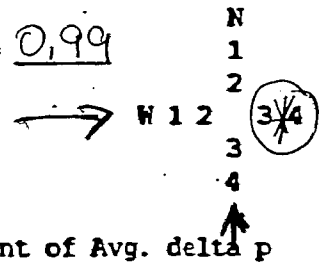
Acc 8.1 .0392 .0011

VELOCITY TRAVERSE

POINT	LOCATION	Δp	TEMP
N-1	0.5"	.037	103
2	1.5"	.040	103
3	4.5"	.035	102
4	5.5"	.035	102
W-1	0.5"	.037	103
2	1.5"	.040	103
3	4.5"	.040	103
4	5.5"	.035	103
	Avg.	.0374	102.750

Pilot Leak Check Pre ✓ Post ✓

Cp = 0.99



*=point of Avg. delta p

$Qs = \left(\sqrt{\frac{\Delta P \times BP}{T(°R)}}\right) \times 3167.2 =$

138.52 ✓ cfm

BP = START 28.78 in Hg

60	28.77
120	28.77
180	28.76
240	28.76
300	28.77
350	28.75

$\bar{X}$ = 28.766

METHOD 5G-1 PARTICULATE SAMPLING DATA Kuma LAB-

DATE 9/11/1999 PAGE 2 OF 2 MODEL # Wood Classic RUN # EPA 1

METER BOX # 511-M METER Y 1.0151 FILTER # (F)824 (R)823

PRE TEST LEAK RATE = .000 CFM @ -16.25 IN. HG .357/.357 FILTER SIZE: 110 mm

POST TEST LEAK RATE = .000 CFM @ -12.00 IN. HG .526/.526 PROBE LENGTH 24" glass

TIME		METER READING CU.FT.	PITOT dp	TNL TEMP. (°F)	METER TEMP. (°F)	GAS METER dh	VAC IN. Hg
CLOCK	ELAPSED						
1630	200	467.102	-.040	96	90	.90	0
40	10	472.675	-.040	96	90	.90	0
50	20	478.250	-.040	95	90	.90	0
1700	30	483.812	-.040	95	90	.90	0
10	40	489.383	-.040	94	90	.90	0
20	50	494.965	-.040	94	90	.90	0
30	60	500.552	-.040	94	91	.90	0
40	70	506.113	-.040	93	91	.90	0
50	80	511.663	-.040	92	90	.90	0
1800	90	517.220	-.040	90	90	.90	0
10	300	522.765	-.040	89	89	.90	0
20	10	528.405	-.040	90	89	.90	0
30	20	533.875	-.040	88	88	.90	0
40	30	539.419	-.040	87	87	.90	0
50	40	544.975	-.040	87	88	.90	0
1900	(50)	550.492	-.040	86	87	.90	0
	60						
	70						
	80						
	90						

VELOCITY TRAVERSE

POINT	LOCATION	ΔP	TEMP
N-1	0.5"	.037	103
2	1.5"	.040	103
3	4.5"	.035	102
4	5.5"	.035	102
W-1	0.5"	.037	103
2	1.5"	.040	103
3	4.5"	.040	103
4	5.5"	.035	103
	Avg.	.0374	102.75

Pilot Leak Check Pre ✓ Post ✓

Cp = 0.99

N 1 2 → W 1 2 (3 or 4) 3 4

*=point of Avg. delta p

$Qs = \left(\frac{\sqrt{(\Delta P \times BP)}}{T(°R)}\right) \times 3167.2 =$

138.52 cfm

BP = START 28.78 in Hg

60	28.77
120	28.77
190	28.76
240	28.76
300	28.77
350	28.75

$\bar{X} = 28.766$

WOODSTOVE DATA SHEET #4-1: INITIAL FILTER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date 1/3/99 Time 12:00 By ATM Front Half ✓ Back Half ✓

Manufacturer: Schleicher & Schuell Size: 11 cm Lot.No.: Z8951 Grade: #25 Glass
Order No. 06220

Filter #	First Wt	Date	Time	By	Second Wt	Date	Time	By	Third Wt	Date	Time	By
801	.7864	1/4/99	1110	pm	.7867	7/18/99	1747	ATM				
802	.8101		1111	"	.8106		1746	ATM				
803	.7927		1112	"	.7931		1744	ATM				
804	.7988		1113	"	.7993		1743	ATM				
805	.7836		1114	"	.7839		1742	ATM				
806	.7758		1115		.7762		1741	ATM				
807	.7948		1116		.7951		1740	ATM				
808	.8028		1117		.8031		1739	ATM				
809	.8098		1118		.8100		1738	ATM				
810	.8120		1119		.8124		1737	ATM				
811	.8093		1120		.8096		1736	ATM				
812	.7993		1121		.7995		1734	ATM				
813	.7832		1122		.7835		1733	ATM				
814	.7820		1123		.7823		1732	ATM				
815	.7949		1124		.7952		1731	ATM				
816	.8229		1125		.8232		1730	ATM				
817	.8129		1340		.8129		1729	ATM				
818	.8157		1341		.8159		1728	ATM				
819	.8001		1342		.8003		1727	ATM				
820	.7967		1343		.7967		1726	ATM				
821	.7980		1344		.7978		1725	ATM				
822	.7868		1345		.7871		1724	ATM				
823	.8039		1346		.8039		1722	ATM				
824	.7843		1347		.7843		1721	ATM				
825	.7911	✓	1348	✓	.7911	✓	1720	ATM				

Checked by AT. Date: 7/20/99 Time 0700

QA REWEIGH

Filter #	WT	Date	Time	By
801	.7863	7/22/99	2150	JM
809	.8100	7/22/99	2145	JM
819	.8002	7/22/99	2152	JM

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB.	DB	%RH	Date	Time	By
49	72	45	6/15/99	1[illegible]	[illegible]
62	77	45	7/18/99	1654	ATM
64	80	41	7/22/99	2145	ATM

Post Weighing Screen Serial Check

	1st	2nd	3rd
0.0000	.0000	.0001	.0000
1.0000	1.0001	1.0001	1.0000

WOODSTOVE DATA SHEET #4-2:
INITIAL BEAKER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date: 8/20/99 Time: 1500 By: A.T.Myren

Beaker #	First Wt	Date	Time	By	Second Wt	Date	Time	By	Third Wt	Date	Time	By
Glass 1	65.4841	8/27	2059	[illegible]	65.4845	8/30/99	1211	ATM				
2	66.1509	8/27	2118	[illegible]	66.1514		1204	ATM				
3	67.8582		2116	[illegible]	67.8578		1207	ATM				
4	67.5890		2108	[illegible]	67.5891		1210	ATM				
6	67.4270		2119	[illegible]	67.4274		1213	ATM				
7	65.5444		2105	[illegible]	65.5446		1220	ATM				
8	66.0219		2121	[illegible]	66.0218		1205	ATM				
9	66.9297		2120	[illegible]	66.9296		1215	ATM				
10	66.0906		2114	[illegible]	66.0902		1209	ATM				
11	65.7072		2112	[illegible]	65.7020		1217	ATM	65.7028	9/8/99	1717	[illegible]
13	57.8946	↓	2110	[illegible]	57.8948	↓	1218	ATM				
									65.7021	9/11	1232	ATM
									65.7022	9/13	1934	[illegible]
SS 20	73.3159	8/27	2125	[illegible]	73.3160	8/31/99	1320	ATM				
21	71.0002	8/27	2126	[illegible]	71.0003	↓	1325	ATM				
22	71.8322	9/11/99	1240	ATM	71.8322	9/13	1719	[illegible]				
23	70.7376	8/27	2131	[illegible]	70.7382	8/30/99	1259	ATM	70.7376	9/8	1715	[illegible]
24	73.2173	8/27	2130	[illegible]	73.2182		1301	ATM	73.2176	9/8	1713	[illegible]
25					72.6505	↓	1253	ATM	72.6504	9/8	1716	[illegible]
26	71.7865	8/27	2132	[illegible]	71.7868	8/31/99	1322	ATM				
27	72.3294	9/11/99	1235	ATM	72.3294	9/8	1718	[illegible]				
28	70.5955	8/27	2127	[illegible]	70.5956	8/31/99	1324	ATM				
29	71.5183	8/27	2133	[illegible]	71.5185	↓	1318	ATM				
30	70.7845	8/27	2128	[illegible]	70.7855	8/30/99	1302	ATM	70.7851	9/8	1714	[illegible]
31	69.6652	8/27	2129	[illegible]	69.6655	8/31/99	1327	ATM				
cont. 23	70.7375	9/11	1233	ATM								
cont. 24	73.2175	9/11	1242	ATM	←							

Checked By: A.T.Myren Date: 9/11&13/99 Time: ATM

QA REWEIGH

Beaker #	WT	Date	Time	By

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
68	83	46	8/27/99	2052	ATM
67	81	48	8/30/99	1154	ATM
63	76	48	8/31/99	1310	ATM
70	84	47	9/8/99	1705	ATM
69	84	46	9/11/99	1202	ATM
74	77	49	9/13/99	1926	ATM

WOODSTOVE DATA SHEET #4-2:
INITIAL BEAKER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date: 6/1/99 Time: 1400 By: A.T.Myren

Beaker #	First Wt	Date	Time	By	Second Wt	Date	Time	By	Third Wt	Date	Time	By
1	65.4847	7/17/99	1636	OBM	65.4847	7/18/99	1612	ATM	← B KAN		K	
2	66.1504		1638	OBM	66.1506	↓	1614	ATM	7/	18/99		
3	67.8572		1640	OBM	67.8567	↓	1616	ATM				
4	67.5881		1642	OBM	67.5880	↓	1618	ATM				
6	67.4268		1644	OBM	67.4266	↓	1620	ATM				
7	65.5436		1648	OBM	65.5437	↓	1622	ATM				
8	66.0212		1660	OBM	66.0211	↓	1623	ATM				
9	66.6294		1652	OBM	66.6295	↓	1625	ATM				
10	66.0889		1654	OBM	66.0888	↓	1627	ATM				
11	65.7015		1656	OBM	65.7013	↓	1628	ATM				
12	56.0655		1658	OBM	56.0653	↓	1632	ATM				
13	57.8948	↓	1700	OBM	57.8944	↓	1630	ATM				

Checked By: A.T.Myren Date: 7/18/99 Time: 1800

QA REVIEW

Beaker #	WT	Date	Time	By

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
65	78	49	7/17/99	1825	ATM
63	77	45	7/18/99	1604	ATM

WST5-Form9,Pg1,Rev4/90
Unit Kuma Wood Classic
Run # EPA 1
Date: 9/11 199

WOODSTOVE DATA SHEET #4-3: CONSTANT FINAL WEIGHTS

FINAL BEAKER WEIGHTS

Beaker #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
24	✓	9/14/99	1700	ATM	73.2262	9/16	0855	ATM	73.2261	9/18	1320	TM				

FINAL FILTER WEIGHTS

	Filter #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
F	824	.8235	9/11/99	1936	ATM	.8229	9/12	2106	ATM	.8229	9/13/99	1940	JM	.8229	9/14	2036	ATM
R	823	.8050	9/11/99	1936	ATM	.8047	9/12	2107	ATM	.8043	9/13/99	1935	JM	.8046	9/14	2038	ATM

QA REWEIGH: FINAL WEIGHTS

Date	Beaker #	Final Wt	By

Date	Filter #	Final WT	By

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	1999 Date	Time	By	WB	DB	%RH
1	9/12	2058	ATM	70	84	49
2	9/13	1926	ATM	64	77	49
3	9/14	2025	ATM	68	84	44
4	9/16	0845	ATM	69	84	46
5	9/16	1655	ATM	70	84	49

SCALE ROOM ENVIRONMENTAL CONDITIONS

6	9/16	1217	ATM	65	78	48
7						
8						
9						

Comments

WOODSTOVE DATA SHEET #4-3: CONSTANT FINAL WEIGHTS

Blank
7/18/99

WST5-Form9, Pg1, Rev4/90
Unit Kuma Wood Classic
Run #
Date: 91 199

FINAL BEAKER WEIGHTS

Beaker #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
1	✓	7/21/99	1435	ATM	65.4852	8/4/99	1715	ATM	65.4846	8/8/99	1742	OBM	65.4847	8/9	1642	ATM

FINAL FILTER WEIGHTS

Filter #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By

QA REWEIGH: FINAL WEIGHTS

Date	Beaker #	Final Wt	By

Date	Filter #	Final WT	By

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	1999 Date	Time	By	WB	DB	%RH
1	8/4	1705	ATM	69	83	49
2	8/8	1700	ATM	64	78	46
3	8/9	1615	ATM	69	84	46
4						
5						

SCALE ROOM ENVIRONMENTAL CONDITIONS

6						
7						
8						
9						

Comments

Dates From 1/9/99

Through 7/17/99

WOODSTOVE DATA SHEET #4-4
SCALE QA SHEET

Scale Mettler
Model AE100
SN K04827

Level	Recali-brated	100g Weight	10g Weight	1.0g Weight	100mg Weight	20mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
L	Yes P.O.	99.9999	10.0001	1.0002	.1003	.0203	1/9/99	1243	ATM	58	[illegible]	48
L	No	100.0002	10.0000	1.0000	.1000	.0200	1/14/99	1113	ATM	62	75	47
L	YES P.O.	99.9998	10.0002	1.0000	.0999	.0201	1/23/99	1100	ATM	63	77	48
L	YES	99.9998	10.0000	1.0000	.1000	.0201	1/24/99	1318	ATM	59	[illegible]	[illegible]
L	YES	99.9996	10.0002	1.0000	.1000	.0200	2/1/99	0910	ATM	55	61	39
L	YES	99.9999	10.0001	1.0001	.1002	.0201	2/2/99	0939	ATM	60	72	46
L	YES	99.9999	10.0001	1.0001	.1001	.0200	2/3/99	1555	ATM	62	[illegible]	47
L	YES	99.9999	10.0000	1.0001	.1001	.0201	2/7/99	1230	ATM	62	76	45
L	YES	99.9998	10.0000	1.0000	.1000	.0200	2/10/99	1600	ATM	63	77	45
L	YES	99.9998	10.0000	1.0001	.1000	.0200	2/19/99	0246	ATM	64	78	46
L	NO	99.9999	10.0000	1.0000	.1000	.0200	2/21/99	1313	ATM	65	[illegible]	41
L	NO	99.9997	10.0000	1.0001	.1000	.0200	3/5/99	1935	ATM	64	80	41
L	YES P.O.	99.9997	10.0000	1.0000	.1001	.0200	3/6/99	1135	ATM	64	80	43
L	YES	99.9997	10.0000	1.0001	.1000	.0200	3/13/99	1526	ATM	65	80	44
L	YES	99.9997	10.0001	1.0001	.1001	.0200	3/14/99	1355	ATM	63	78	43
L	NO	100.0001	10.0000	1.0000	.1000	.0200	3/15/99	1622	ATM	66	81	45
L	YES	99.9997	10.0000	1.0001	.1000	.0200	3/16/99	2025	ATM	65	[illegible]	39
L	YES	99.9996	10.0000	1.0001	.1001	.0200	3/17/99	1615	ATM	62	[illegible]	17
L	YES	99.9997	10.0000	1.0001	.1000	.0200	3/18/99	2140	ATM	66	84	43
L	YES	99.9998	10.0000	1.0000	.1000	.0200	3/20/99	1300	ATM	64	84	32
L	YES	99.9999	10.0000	1.0001	.1001	.0201	3/21/99	2215	ATM	61	74	47
L	YES	99.9997	10.0000	1.0000	.1001	.0200	3/22/99	1122	ATM	65	[illegible]	[illegible]
L	YES	99.9997	10.0000	1.0001	.1000	.0200	3/23/99	1115	ATM	69	[illegible]	46
L	YES	99.9999	10.0000	1.0002	.1001	.0201	3/24/99	1120	ATM	72	[illegible]	[illegible]
L	YES	99.9999	10.0000	1.0002	.1001	.0201	3/29/99	2038	ATM	69	72	[illegible]
L	NO	99.9999	10.0002	1.0002	.1001	.0202	3/30/99	0610	ATM	66	80	47
L	YES	99.9999	10.0000	1.0000	.1001	.0201	3/31/99	1000	ATM	64	80	41
L	NO	99.9996	10.0000	1.0000	.1001	.0201	4/5/99	1730	ATM	64	80	41
L	YES	99.9997	10.0001	1.0001	.1001	.0201	4/6/99	1030	ATM	61	[illegible]	44
QC	Scale Audit	4/6/97	— Wt. / Scale Calibration Audit									
L	NO	100.0003	10.0001	1.0001	.1001	.0201	4/6/99	1730	ATM			
L	YES	99.9998	10.0001	1.0001	.1001	.0200	4/7/99	1724	ATM	66	85	33
L	NO	99.9996	10.0000	1.0001	.1001	.0201	4/8/99	1346	ATM	67	80	50
L	YES	99.9997	10.0000	1.0000	.1000	.0200	4/16/99	1230	ATM	66	82	42
L	YES	99.9997	10.0000	1.0000	.1000	.0200	4/17/99	1625	ATM	68	84	43
L	No	99.9999	10.0000	.9998	.0999	.0198	6/19/99	1050	ATM	69	72	45
L	YES	99.9996	10.0001	1.0002	.1001	.0202	7/17/99	1825	ATM	65	78	49

WOODSTOVE DATA SHEET #4-4
SCALE QA SHEET

Dates From 7/18/99

Through 9/16/99

Scale Mettler
Model AE100
SN K04827

Level	Recali-brated	100g Weight	10g Weight	1.0g Weight	100mg Weight	20mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	No	99.9996	10.0000	1.0001	.1000	.0201	7/18/99	1604	ATM	63	77	45
✓	YES	99.9997	10.0000	1.0001	.1001	.0201	7/19/99	1835	ATM	64	77	49
✓	YES	99.9996	10.0000	1.0002	.1002	.0202	7/20/99	1854	ATM	71	85	80
✓	Yes	99.9997	10.0001	1.0001	.1001	.0201	7/21/99	1306	ATM	69	84	50
✓	Yes P.O.	99.9996	9.9999	1.0000	.1000	.0200	7/22/99	2145	ATM	64	80	41
✓	Yes	99.9998	10.0000	1.0000	.1000	.0200	7/23/99	0745	ATM	62	76	45
✓	No	99.9998	10.0000	1.0000	.1000	.0200	7/24/99	1346	ATM	66	80	47
✓	YES P.O.	Would not calibrate					8/3/99	2117	ATM	70	84	49
✓	Yes	99.9998	10.0001	1.0002	.1000	.0201	8/4/99	1705	ATM	69	83	49
✓	NO	99.9998	10.0001	1.0001	.1000	.0200	8/5/99	2106	ATM	65	78	49
✓	Yes	99.9998	10.0000	1.0000	.1000	.0200	8/6/99	1536	ATM	68	81	50
✓	No	99.9999	10.0000	1.0001	.1000	.0200	8/7/99	1513	ATM	66	80	47
✓	Yes	99.9996	10.0001	1.0002	.1001	.0201	8/8/99	1700	ATM	64	78	46
✓	Yes	99.9997	10.0000	1.0001	.1000	.0200	8/9/99	1225	ATM	68	82	48
✓	Yes	99.9999	10.0001	1.0001	.1001	.0201	8/9/99	1615	ATM	69	84	46
✓	No	99.9998	10.0000	1.0000	.1000	.0200	8/10/99	1327	ATM	70	84	49
✓	Yes	99.9998	10.0000	1.0000	.1001	.0200	8/11/99	1043	ATM	67	81	48
✓	Yes	99.9996	10.0000	1.0001	.1001	.0201	8/11/99	2035	ATM	64	78	46
✓	Yes	99.9997	10.0000	1.0001	.1000	.0200	8/13/99	1230	ATM	64	80	47
✓	Yes	99.9998	10.0001	1.0002	.1002	.0201	8/14/99	1929	ATM	63	76	48
✓	Yes	99.9998	10.0000	1.0001	.1001	.0201	8/16/99	1135	ATM	64	77	48
✓	Yes	99.9998	10.0001	1.0001	.1001	.0201	8/17/99	1750	ATM	68	82	46
✓	Yes	99.9997	10.0000	1.0001	.1001	.0200	8/18/99	1650	ATM	70	84	47
✓	No	99.9999	10.0001	1.0000	.1000	.0201	8/20/99	2032	ATM	64	83	46
✓	NO	99.9997	10.0001	1.0002	.1001	.0202	8/30/99	1154	ATM	67	81	48
✓	No	99.9999	9.9999	1.0000	.1000	.0200	8/31/99	1310	ATM	63	76	49
✓	Yes	99.9997	10.0000	1.0000	.1000	.0200	9/1/99	1844	ATM	65	79	44
✓	Yes	99.9998	10.0000	1.0000	.1000	.0200	9/2/99	1032	ATM	60	74	43
✓	Yes	99.9998	10.0000	1.0002	.1002	.0200	9/8/99	1705	ATM	70	84	47
✓	YES	99.9996	10.0001	1.0002	.1001	.0201	9/11/99	1202	ATM	69	84	46
✓	Yes	99.9996	10.0000	1.0001	.1001	.0201	9/12/99	2058	ATM	70	84	49
✓	Yes	99.9996	10.0001	1.0001	.1000	.0201	9/13/99	1926	ATM	69	84	49
✓	Yes	99.9997	10.0001	1.0002	.1002	.0202	9/14/99	1335	ATM	61	73	53
✓	Yes	99.9998	10.0001	1.0002	.1002	.0201	9/14/99	2025	ATM	84	68	44
✓	Yes	99.9998	10.0001	1.0003	.1001	.0200	9/15/99	0820	ATM	82	66	42
✓	Yes	99.9996	10.0001	1.0001	.1001	.0201	9/16/99	0845	ATM	69	84	46
✓	No	99.9996	10.0000	1.0000	.1000	.0200	9/16/99	1653	ATM	70	84	49

Dates From 9/17/99

Through _____

WOODSTOVE DATA SHEET #4-4
SCALE QA SHEET

Scale Mettler
Model AE100
SN K04827

Level	Recali-brated	100g Weight	10g Weight	1.0g Weight	100mg Weight	20mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	Yes	99.9993	10.0000	1.0001	.1001	.0201	9/17/99	2045	ATM	66	79	49
✓	Yes	99.9997	10.0000	1.0000	.1001	.0200	9/18/99	1217	ATM	65	79	49
✓	No	99.9996	10.0000	1.0000	.1000	.0289	9/19/99	1245	ATM	62	75	49
✓	Yes	99.9998	10.0001	1.0001	.1001	.0201	9/23/99	2025	ATM	65	79	47
✓	Yes	99.9997	10.0000	1.0000	.1000	.0201	9/24/99	1145	ATM	64	77	49

Unit: Kuma Wood Classic
Run: EPA 1
Date: 9/11 1999
Technicians: AJM RLS
WST20, Form5

Woodstove Particulate Catch Processing Sheet
Woodstove Data Sheet #5
EPA M5G-1

Filters

(F)
Filter # 824 Beaker # 24 Final Wt. 73.2261 g
Final Wt .8229 g Ml 30 Tare Wt. 73.2175 g
Tare Wt .7843 g Desc. Acetone Net Wt. .0086 g
Net Wt .0386 g

(R)
Filter # 823 Beaker # _____ Final Wt. _____ g
Final Wt .8046 g Ml _____ Tare Wt. _____ g
Tare Wt .8039 g Desc. _____ Net Wt. _____ g
Net Wt .0007 g

Acetone Blank Calculation: Blank done 7/18/99

Blank Beaker # 1 Final Wt 65.4847
Ml 50 Tare Wt 65.4847
Desc Acetone Net Wt .0000

.0000 g ÷ 50 ml = .0000 g/ml

Particulate Catch Calculation

Filter: .0386 g
Filter: .0007 g
Beakers: .0086 (Total Catch) − (30 (Ml of Acetone) × .0000 (Blank Value/Ml of Acetone)) = .0086 g
Total Catch = .0479 g

Unit Kuma Wood Classic
Run # EPA 1
Date 9/11/1999
Technician ATM 12.5
WST6-Form1, Rev8/96

MISCELLANEOUS TEST DATA
WOODSTOVE DATA SHEET #8

Useable Firebox Dimensions: See QC Section Useable Volume: 2.228 ft³

Dilution Tunnel Draft (If applicable): Start 00.0 Stop 00.0

Test Chamber Air Velocity: Start: 00.0 Stop: 00.0 Avg: 00.0

Wet Bulb/ Start: WB: 58 °F DB: 72 °F 1.25 % Amb Moisture 41 %RH

Dry Bulb Stop: WB: 62 °F DB: 77 °F 1.40% Amb Moisture 42 %RH

$\bar{X}$ = 1.325 % Ambient Moisture $\bar{X}$ = 41.5 % Relative Humidity (RH)

Empty Stove Wt: 419.3 lbs.

Empty Stove Wt with Stack (Inc. Oil Seal) Wet: 510.7 lbs. Dry: 509.0 lbs.

Empty Stove Wt with Stack and Ash Ash: — lbs. Total: — lbs.

Kindling Wt. Paper: 0.3 lbs. Wood: 4.0 lbs.

Pre Burn Fuel Wt. 14.0 + 14.0 + 14.2 Total: 42.2 lbs. ✓

Total Kindling and Pre Burn Fuel Wt 46.5 lbs. ✓

Coal Bed Wt-lbs: Range (512.6 - 512.0) 3.6-3.0 lbs. Actual: 3.2 lbs.

Allowable Amount of Charcoal that can be removed:

Coal Bed Wt. Range $\frac{3.6}{\text{Upper Wt.}} + \frac{3.0}{\text{Lower Wt.}} / 2 \times .25 = .8$ lbs.

Test Fuel Wt-lbs: Ideal 15.5 lbs. Range: 17.1-14.1 lbs. Actual: 14.6 lbs.

Test Fuel Size (pcs.) (.75 x 1.5 x 5" Flanges) 16 Pcs. ✓

2 x 4's x 16 4/16	"	3 Pcs	6.7 lbs.	45.9 % ✓
4 x 4's x 16 4/16	"	2 Pcs	7.9 lbs.	54.1 % ✓

✓ ✓ ✓

Est. Dry Burn Rate (Kg/Hr.) $\frac{14.6 - (14.6 \times 17.714)}{2.2046} \times \frac{60}{350} = 0.9342$ Est. Dry Burn Rate (Kg/Hr) ✓

Est EPA Heat Output (HO_E) (Avg BTU's/Hr) (19,140) x $\frac{63}{100}$ x .9342 = 11,265 Est Heat Output (HO_E) BTU's/Hr ✓

Comments:

Stove Operating Data
Woodstove Test Data Sheet #9
Cold Start

Unit: KUHA WOOD CLASSIC
Run: EPA 1
Date: 9/11/99
Technician(s): ATH, DLS,
Data Sheet #9 - Rev 1/98-Pg.2

Fire Started: 0825 P.D.S.T.

Warm up and Preburn: Primary Air: Wide open from ignition until the start of preburn when the primary air control(s) was (were) adjusted to the run setting of 3/8" OPEN. At the run setting until the start of the test.

Secondary Air: No Controls. Naturally Drafted.

Secondary Burn/Cat Bypass: N/A

Charcoal Bed Preparation: Broke up, raked and leveled the coal bed prior to the addition of each warm up/pre burn fuel charge. Starting 1130 before the start of the test, broke up, raked and leveled the coal bed. In stove for 33 seconds.

Test: Door wide open during loading 0 min 58 sec, then closed,

Primary Air: Wide open during the start of the test until 4165.
Adjusted to the run setting of 3/8" open between 4:55 and 5:00.
At the run setting of 3/8" open at 5:00 into the run.

Secondary Air: No Controls, Naturally drafted.

Secondary Burn/Cat Bypass: N/A

Fan: ON/OFF during the warm up, ON/OFF High during the preburn, ON/OFF at the start of the test, ON/OFF for the first 30 minutes of the test, ON/OFF high at 30 minutes into the test, ON/OFF for the rest of the test.

Test Run Anomalies: Start after shut down was a little slower than expected,

Note: 3/8" open = rod at 3/4" from side of heat shield.
3/8" = Stop.

Unit Kuma Wood Classic
Run # EPA 1
Date 9/11/1999
Technician ATM RLS

WST7-Form2-A, Rev10/88

WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-1

Wood Data: Kindling: A mix of the below grades.

	Size	Mill	Grade	Species
Pre Burn	2X4	Canyon Lumber	#2 & Better	D. Fir SFC Grn
Test Fuel	2X4	Canyon Lumber	#2 & Better	D. Fir SFC Grn
	4X4	R.I.B. Const.	#1	D. Fir SFC Grn

All grades WCLB Rules unless otherwise noted.

Warm up Information:

1st Warm up/Pre Burn Fuel charge (14.0 lbs) added at 0845.
2nd Warm up/Pre Burn Fuel charge (14.0 lbs) added at 0946.
3rd Warm up/Pre Burn Fuel charge (14.2 lbs) added at 1046.
4th Warm up/Pre Burn Fuel charge (lbs) added at .
5th Warm up/Pre Burn Fuel charge (lbs) added at .
6th Warm up/Pre Burn Fuel charge (lbs) added at .
7th Warm up/Pre Burn Fuel charge (lbs) added at .
8th Warm up/Pre Burn Fuel charge (lbs) added at .

The coals were scooped out of the stove immediately prior to adding the 3rd pre burn/warm up fuel charge. The stove lost 1.7 lbs. 3.0 lbs. of coals were put back in the stove after the scoop.

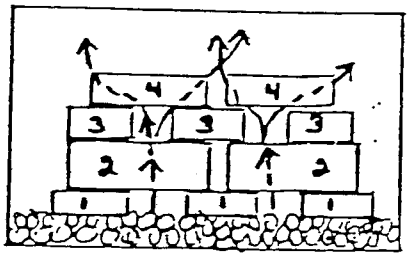
All pre burn/warm up fuel pieces were [redacted] 16" inches long. All preburn pieces/fuel charges were "ricked" in the stove. The pieces in the bottom layer in each rick contained 2 pcs that were 16 inches long and were loaded flat and perpendicular to the door. The pieces in the second layer in each rick were loaded on their side (edge) approximately parallel to the door and contained 4 pcs 16 inches long. The third layer (and fourth layer if present) was loaded flat, perpendicular to the door and contained 2 pcs 16 inches long. The majority of the pieces in each rick were in the second layer which had an approximate 0.5-1.0" space between pieces. (The loading directions indicate the direction of the longest dimension on each piece relative to the loading door opening.) Each pre burn/warm up fuel charge normally weighs within the weight range allowed for the actual test fuel charge

Unit Kuma Wood Classic
Run # EPA 1
Date 9/11/1999
Technician ATM RLS
Page 2 of 4
WST7-Form2-A, Rev 6/90

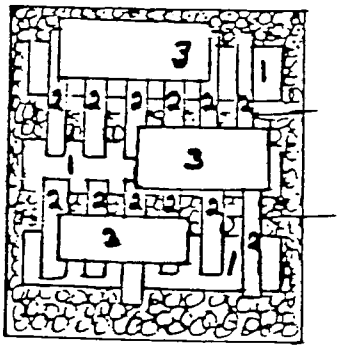
WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-2

Warm up Information (cont.):

Each warm up/preburn fuel charge was ricked in exactly (as much as possible) the same manner and the weight of each rick was usually within the allowable weight range for the test fuel charge. The physical arrangement and alignment of each rick was designed to accomplish three (3) things: (1)The bottom layer was nestled firmly into the coal bed and was as close to being level with the bottom of the stove as possible, thus providing a stable loading platform for the rest of the rick, keeping it in a ricked state (as opposed to a col- lapsed or fallen down state) untill the rick reached the charcoal stage and sags or collapses of its own accord. (2) It enhances the flow of primary air through the ricked preburn fuel charge, for the primary air would flow through the spaces between the pieces in the first layer and then up through the spaces between the pieces in the second, third and, if present, fourth layers. (3) It maximized, as much as possible, the surface to volume ratio of each preburn fuel charge, thereby allowing the fire immediate access to as much wood surface as possible and, thereby, insuring uniform charcoalization. All three of these enhance combustion and so get the stove as hot as possible during the warm up period, therby maximizing the amount of heat (BTU's) stored in the stove. The actual preburn was not started until the stove surface temperatures had maximized and stabilized, thus indicating that the amount of heat stored in the stove had peaked. For this stove, the thermal storage was monitored using the Top surface temperature(s) and the peak value(s) obtained were 975 °F.



Front View



Top View

The arrows indicate the direction of the air flow through the rick.

The primary air was adjusted to the run setting of 3/8" open 4.8 lbs above the upper charcoal bed weight.

Unit Kuma Wood Classic
Run # EPA 1
Date 9/11/99
Technician AJM RLS
Page 3 of 4
WST5-Form2-Rev11/89

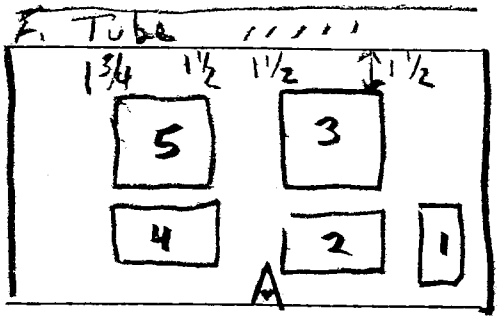
WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-3

Additional Comments: Test Start Sequence: ① Turned fan off. ② Opened primary air control wide open ③ opened door ④ loaded test fuel ⑤ cleared coals away from the LPSO ⑥ Photograph ⑦ closed door.

Total Elapsed Time: 0:58

Test Fuel Charge Loading Information:

Test Fuel Charge and Loading Sequence Diagram



FRONT of stove view

4 X 4's: 3 & 5

2 X 4's: 1, 2 & 4

Loading Sequence: 1, 2, 3, 4 & then 5 last

Driest Pcs in Load 2 & 4, 3

Loaded the test fuel charge on an essentially level, medium sized, hot coal bed (in appearance, color and temperature for a Low (≤1.0 kg/hr) burn rate. Load 0:58 Ignition 1 NO 1:35 1:10 Flames (VC) to baffle. 1:55 Flames spreading over tops of 4X4's, + some flames on L. Side of Fuel Load. 2:33 Secondaries starting to flow forward. 2:49. Past 1st Tube. 3:00 Front Tube starting to ignite (flickers). 3:29 Flames Full width of the fuel load. 3:54 Gas Balance.
5:00 Flames ↓ Maintained a hot pocket with flames & VC to baffle plus secondaries on top of 3 & 5.
6:25 Out of balance. No Secondaries. Just an occasional flicker.
8:02 Steady Secondary flickers / flames above 3.
8:26 Secondaries also above 5.
8:50 Secondaries full width above 3 & 5. Balance 4.7/1.69
9:16 Flames / secondaries forward to front tube.
9:35 Flames / secondaries past front tube on L & C.

Unit Kuma Wood Classic
Run # EPA 1
Date 9/11/99
Technician AJM RLS

WST5-Form2-Rev10/88

WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-4

Additional Comments:

10:25 Front Tube igniting on L above 5.
10:45 Almost in Balance
* 10:55 Gas Balance - barely 7.4/.72
11:37 Flames on the Left Side of L Stack
Secondaries do not seem to have as much velocity as before.
14:10 Secondary flickers on front tube above 3
15:00 Center Canyon center sprays all lg.
16:00 UC flames ↑
17:40 Secondaries have spread to right over Pc 1
18:45 Flames starting to come forward over front tube w/ 2nd flickers off front tube - full width
25:00 Flickers along (on) front tube increasing.
26:00 CO_2 ↑, CO → then ↑
Looks like LPSO air has burnt to far back too quickly, Front portion of fuel load not igniting properly.
28:45 CO ↓ slowly.
30:00 Fan On High 11.3/.73 Burn still hasn't really gotten going.
31:30 CO finally ↓ ↓ a slower start than anticipated.
33:45 Rear of front tube dull orange.

Unit: Kuma Wood Classic
Run: EPA 1
Date: 9/11/1999
Technician: ATM RLS

FUEL MOISTURE
WOODSTOVE TEST DATA SHEET #10

WST1-Form7-Rev11/89

Room Temperature: 77 °F Correction Factor: 0

NOTE: Record readings to the nearest 0.5% moisture
Uncor Values are corrected for temperature: Yes ✓. No ____
Time Test Fuel Moisture Readings taken at: 1045
Calibration Checks: X — Y — 12.5 12.7 22.0 22.0

Pc #	Dimen	Use	Top Uncor	Top Cor	Bottom Uncor	Bottom Cor	Side Uncor	Side Cor	Piece Avg Corrected
1	2X4X8'	K	12.5	13.3	12.5	13.3	12.0	12.8	(13.133)
2									
3									
4	2X4X10'	P	19.0	20.3	19.0	20.3	18.5	19.8	20.133
5	2X4X8'	|	18.5	19.8	18.5	19.8	19.5	20.9	20.167
6	2X4X8'	|	19.0	20.3	20.0	21.4	20.5	22.0	21.233
7	2X4X10'	↓	22.0	23.7	22.0	23.7	22.0	23.7	23.700
8									(85.233)
9									
10	2X4-16 1/16"	T	18.0	19.2	18.0	19.2	18.0	19.2	19.200
11	"	|	19.5	20.9	20.0	21.4	19.5	20.9	21.067
12	"	↓	22.5	24.3	22.5	24.3	22.5	24.3	24.300
13									
14	4X4-16 1/16"	T	21.5	23.1	22.0	23.7	22.0	23.7	23.500
15	"	↓	18.0	19.2	18.0	19.2	19.0	20.3	19.567
16									(107.634)
17									
18									
19	5X1.5X.75	Spacers	19.5	20.9	20.0	21.4	20.0	21.4	21.233 OUT-SPACERS
20									

	Kindling	Pretest Fuel	Test Load
% Moisture - Dry Basis:	13.133 %	21.308 %	21.527 %
% Moisture - Wet Basis:	11.~~71~~ %	17.565 %	17.714 %
	.608		

To obtain Wet from Dry: $\frac{100 \times \%\ \text{Dry Rdg.}}{100 + \%\ \text{Dry Rdg.}}$ = % Moisture, Wet Basis

Acceptable Ranges: 16-20% wet; 19-25% dry
(17.5 - 22.5 on Meter [Uncor reading] at 70°F)

Key for Use: K= Kindling P= Pretest Fuel T= Test Fuel

Unit: Kuma Wood Classic
Run#: EPA 1
Date: 9/11/1999
Technician: ATM RLS

WOOD DENSITY DETERMINATION
WOODSTOVE TEST DATA SHEET #11

WST2-form11-Rev 6/90

Wood Piece: Nominal Dimensions: 3½" x 3½" x 1½" IN

Depth (D): IN 1.556 cm 3.952

Width (W): IN 3.537 cm 8.984

Length (L): 3.487 cm IN
3.498 cm IN
3.491 cm IN
3.502 cm IN

Length $\bar{X}$ = IN 3.495 cm 8.877

Volume: 315.176 cm^3
(D X W X L)

MOISTURE: Room Temperature: 70 °F Correction Factor: 0

Uncorrected Meter Readings Corrected for temperature: Yes ✓ No ___

NOTE: Record moisture meter readings to the nearest 0.5%

	Uncor	Cor
Top:	19.5	20.9 %
Bottom:	19.5	20.9 %
Side:	19.0	20.3 %
$\bar{X}$:		20.700 %

Avg % Moisture (Dry) 20.700 %

Aug % Moisture (Wet) 17.150 %

Scale: Leveled In ✓ Out ✓
Zeroed: In ✓ Out ✓

Wet Weight: 156.4 g Dry Weight: 132.8 g

% Moisture Dried Basis: 15.090 %
[1 - (Dry Wt ÷ Wet Wt)] X 100

	Date	Time	Temp
Into Dryer	9/11/99	1035	214 °F
Out of Dryer	9/22/99	1559	214 °F

(Minimum Time in Dryer: 24 hrs.) Minimum Dryer Temp 100°C (212°F)

Density = 132.8 g (dry wt) ÷ 315.176 cm^3 (volume) = 0.4214 g/cm^3

Pellet Fuel Moisture Content Determination

Tare Beaker Wt. _____ g

Wet Wt: _____ g - _____ g = _____ g
Gross Wet Wt. Tare Beaker Wt. Net Wet Wt.

Dry Wt: _____ g - _____ g = _____ g
Gross Dry Wt. Tare Beaker Wt. Net Dry Wt.

% Moisture Dried Basis: _____ %
[1 - (Net Dry Wt ÷ Net Wet Wt.)] X 100

BURN RATE AND FLUE GAS DATA
WOC OVE DATA SHEET #12
WST2-Form 14 Rev 1/88

Unit: Kuma Wood Classic Date: 9/11/ 199
Run: EPA 1 Technician(s): ATM RLS
Page: 1 of 3

END Wt: 572.2 lbs.

Minute Time	Scale Wt	lbs left	Burn Rate	CO_2 v.	CO_2 %CO_2	O_2 v.	O_2 %O_2	Tel	CO v.	CO %CO	Bal	Wet Bulb	Dry Bulb	% H_2O	Calc W/B	Stack	SO_2 v.	SO_2 PPM	Static Press.	Comments
0 1310	526.8	14.6	0	.277	6.87	51.7	12.92		22.6	1.14	6.0	86	90	4.1	109	237			-.033	Flow
5 15	525.9	13.7	.9	.371	9.19	37.7	9.42		13.9	0.71	12.9	96	108	5.2	132	478			-.067	SO_2 1.5
10 20	525.5	13.3	.4	.191	4.75	60.1	15.01		12.4	0.64	7.4	88	98	4.2	116	307			-.047	CO_2 1.5
15 25	525.0	12.8	.5	.333	8.25	45.7	11.42	GAS BAL 11 MIN.	15.2	0.78	(10.6)	90	111	4.0	117	317			-.050	O_2 1.5
20 30	524.4	12.2	.6	.337	8.35	47.0	11.74		14.7	0.74	11.3	96	125	4.6	118	315			-.050	CO 1.5
25 35	523.8	11.6	.6	.372	9.22	44.1	11.02		16.3	0.84	11.0	102	130	5.8	121	327			-.052	
30 40	523.2	11.0	.6	.425	10.52	39.2	9.79		17.0	0.86	12.2	110	134	7.8	129	347			-.055	
35 45	522.6	10.4	.6	.492	12.17	32.9	8.22		10.9	0.55	22.1	123	137	11.5	136	373			-.057	
40 50	521.8	9.6	.8	.547	13.53	28.7	7.17		6.0	0.30	45.1	126	138	13.0	141	392			-.059	
45 55	521.1	8.9	.7	.572	14.15	26.3	6.57		4.4	0.23	61.5	128	139	14.0	143	400			-.060	
50 1400	520.5	8.3	.6	.561	13.87	27.4	6.85		5.8	0.30	46.2	127	137	13.5	143	405			-.060	
55 05	519.9	7.7	.6	.552	13.65	28.3	7.07		4.2	0.22	62.1	126	136	13.0	141	402			-.060	
																(4300)			(.650)	Flow
60 10	519.3	7.1	.6	.555	13.73	28.1	7.02		2.9	0.16	86.8	125	136	13.0	141	399			-.060	SO_2 1.5
65 15	518.7	6.5	.6	.559	13.83	27.7	6.92		3.6	0.19	72.8	124	135	12.5	140	399			-.059	O_2 1.5
70 20	518.1	5.9	.6	.560	13.85	27.8	6.95		2.4	0.13	106.5	123	135	12.0	140	395			-.058	O_2 1.5
75 25	517.6	5.4	.5	.559	13.83	27.7	6.92		2.5	0.14	98.8	122	134	12.0	139	393			-.058	CO 1.5
80 30	517.1	4.9	.5	.520	12.86	31.2	7.80		4.0	0.20	64.3	119	132	10.5	135	378			-.056	
85 35	516.7	4.5	.4	.500	12.37	33.1	8.27		6.4	0.28	44.2	117	130	10.0	134	367			-.055	
90 40	516.3	4.1	.4	.462	11.43	35.9	8.97		8.3	0.43	26.6	115	127	9.6	132	353			-.052	
95 45	516.0	3.8	.3	.431	10.67	38.4	9.59		13.1	0.67	15.9	112	124	8.5	130	343			-.050	
100 50	515.7	3.5	.3	.379	9.39	42.7	10.67	AUTO BAL.	19.4	0.98	(9.6)	109	120	8.1	127	320			-.048	
105 55	515.5	3.3	.2	.342	8.48	44.6	11.14		20.6	1.04	8.1	106	116	7.4	123	297			-.045	
110 1500	515.3	3.1	.2	.325	8.06	46.3	11.67		20.1	1.01	8.0	103	112	6.8	121	284			-.042	
115 05	515.2	3.0	.1	.302	7.49	48.6	12.14		20.9	1.06	7.1	99	108	6.0	117	272			-.040	
																(4200)			(.623)	
																8500			1.273	

BURN TE AND FLUE GAS DATA
WOODSTOVE DATA SHEET #12
WST2-Form 14 Rev 1/88
END WT.: 512.2 lbs.

Unit: KUMA WOOD CLASSIC Date: 9/11/99
Run: EPA1 Technician(s): ATH, RLS.
Page: 2 of 3

Minute / Time	Scale Wt	lbs left	Burn Rate	1 CO2 v.	1 CO2 %CO2	2 O2 v.	2 O2 %O2	Tel	3 CO v.	3 CO %CO	Bal	T/C(1) Wet Bulb	T/C(2) Dry Bulb	% H2O	T/C(3) Calc W/B	Stack	4 SO2 v.	4 SO2 PPM	Static Press.	Comments
120 / 1510	515.1	2.9	.1	.296	7.34	48.8	12.19		22.9	1.15	6.4	97	106	5.6	116	265			-.037	Flow
125 / 15	515.0	2.8	.1	.285	7.07	50.0	12.49		21.9	1.09	6.5	94	104	5.0	113	258			-.036	SO_2 1.5
130 / 20	514.9	2.7	.1	.279	6.92	50.5	12.62		22.0	1.10	6.3	91	104	4.4	111	251			-.035	CO_2 1.5
135 / 25	514.8	2.6	.1	.280	6.95	50.9	12.72		19.4	0.99	7.0	89	105	4.1	110	247			-.035	O_2 1.5
140 / 30	514.7	2.5	.1	.277	6.87	50.9	12.72		20.4	1.03	6.7	88	105	4.0	109	243			-.035	CO 1.5
145 / 35	514.6	2.4	.1	.266	6.60	52.2	13.04		20.2	1.02	6.5	87	105	3.7	108	239			-.034	
150 / 40	514.6	2.4	0	.259	6.43	52.7	13.16		20.9	1.06	6.1	86	104	3.5	107	236			-.033	
155 / 45	514.5	2.3	.1	.253	6.28	53.9	13.46		20.5	1.04	6.0	86	104	3.5	106	231			-.032	
160 / 50	514.4	2.2	.1	.263	6.53	52.7	13.16		19.3	0.98	6.7	85	104	3.4	106	229			-.032	
165 / 55	514.3	2.1	.1	.259	6.43	53.1	13.26		21.4	1.07	6.0	85	104	3.4	105	226			-.031	
170 / 1600	514.3	2.1	0	.241	5.99	54.7	13.66		23.6	1.20	5.0	85	104	3.4	105	223			-.030	
175 / 05	514.2	2.0	.1	.236	5.86	54.9	13.71		26.3	1.33	4.4	84	103	3.3	104	219			-.030	
																(2867)			(.400)	Flow
180 / 10	514.1	1.9	.1	.226	5.62	55.6	13.89		29.5	1.49	3.8	84	103	3.3	104	216			-.029	SO_2 1.5
185 / 15	514.1	1.9	0	.221	5.49	56.3	14.06		31.3	1.55	3.5	84	103	3.3	103	214			-.029	CO_2 1.5
190 / 20	514.0	1.8	.1	.218	5.42	55.9	13.96		34.3	1.72	3.2	84	102	3.3	103	211			-.028	O_2 1.5
195 / 25	513.9	1.7	.1	.219	5.44	55.8	13.94		35.8	1.80	3.0	84	102	3.3	103	210			-.028	CO 1.5
200 / 30	513.9	1.7	0	.217	5.39	56.0	13.99		36.0	1.82	3.0	84	102	3.3	103	208			-.027	
205 / 35	513.8	1.6	.1	.221	5.49	56.1	14.01		31.1	1.55	3.5	84	102	3.3	103	206			-.026	
210 / 40	513.7	1.5	.1	.226	5.62	55.8	13.94		30.3	1.52	3.7	84	102	3.3	103	205			-.026	
215 / 45	513.7	1.5	0	.227	5.64	55.6	13.89		31.6	1.59	3.5	84	101	3.3	103	204			-.026	
220 / 50	513.6	1.4	.1	.225	5.59	55.7	13.91		31.7	1.60	3.5	84	101	3.3	101	201			-.025	
225 / 55	513.6	1.4	0	.224	5.57	55.9	13.96		31.9	1.61	3.5	84	101	3.3	101	200			-.025	
230 / 1700	513.5	1.3	.1	.222	5.52	55.8	13.94		33.2	1.67	3.3	84	100	3.4	100	199			-.025	
235 / 05	513.4	1.2	.1	.217	5.39	56.2	14.04		35.4	1.77	3.0	84	100	3.4	100	198			-.025	
																(2472)			(.319)	
																5339			.719	

Pre Burn Tare Wt. 4.8 lbs. Up 517.4 lbs.
Test Start wt. Range 512.6 - 512.0 lbs.

PRE BURN DATA RECORD SHEET #13
WST2-Form16

BARO. PRESSURE 28.78 "Hg

Unit: Kuma Wood Classic Date: 9/11/199
Run: EPA 1 Technician(s): ATM RLS
Page: 1 of 1

Point 2nd. Set	Minute Time	Scale Weight	Burn Rate	T/C#-3 Stack	4 Stove Top	5 Left Side	6 Back	7 Right Side	8 Bottom	9 Firebox	10 2nd Burn Catalytic	11 Room Temp	Static	Hot Box On Comments 3/4" FROM SIDE
1285	0	517.4	0	680	957	618	438	612	467	925	1577	75	-.089	Primary Air Set at 3/8" OPEN
1264	5	516.5	.9	533	875	647	430	626	468	903	1445	77	-.077	Secondary Air Set at N/A
1253	10	515.8	.7	475	809	653	425	626	468	936	1387	76	-.070	Fan: ON HIGH
1239	15	515.2	.6	440	747	658	422	620	465	946	1357	76	-.066	TUNNEL ON AT: 1112
1232	20	514.7	.5	421	696	658	419	612	459	1059	1317	75	-.063	Buckets IN
1203	25	514.3	.4	402	655	657	419	605	453	1019	1356	76	-.061	ANALYZERS SPANNED
1135	30	514.0	.3	366	603	654	415	596	447	1038	1194	76	-.055	Pumps turned on at: 1145
1033	35	513.7	.3	352	560	641	406	584	441	977	1208	76	-.053	RAKE COALS ΔT
986	40	513.6	.1	332	536	629	396	573	437	960	1185	75	-.051	514.2
968	45	513.5	.1	317	501	615	387	561	432	944	1142	75	-.047	Check WB/DB: 499.2
940	50 1200	513.4	.1	304	471	601	378	550	429	927	1117	75	-.046	485.8
919	55 05	513.3	.1	295	451	590	371	540	427	912	1119	75	-.043	475.8
														Probe IN TUNNEL
903	60 10	513.2	.1	288	435	578	365	531	427	898	1099	75	-.042	
884	65 15	513.1	.1	282	425	567	359	524	427	888	1074	75	-.041	460.4
855	70 20	513.0	.1	271	408	557	353	515	428	863	995	75	-.040	452.2
840	75 25	513.0	0	267	397	546	347	505	430	847	977	75	-.039	445.0
832	80 30	512.9	.1	262	388	538	341	497	431	843	973	75	-.037	439.0
823	85 35	512.8	.1	259	381	529	336	489	432	833	979	75	-.037	433.4
818	90 40	512.7	.1	256	375	522	331	481	433	826	968	75	-.036	428.4
813	95 45	512.6	.1	253	371	515	326	475	433	819	979	74	-.035	424.0
808	100 50	512.5	.1	251	367	510	323	469	435	816	1007	75	-.035	420.8
801	105 55	512.5	0	248	366	505	319	465	436	807	991	75	-.034	418.2
791	110 1300	512.4	.1	245	363	501	315	460	436	802	982	75	-.034	415.0
789	115 05	512.3	.1	239	355	496	310	455	437	794	870	75	-.033	410.6
780	120 10	512.2	.1	237	348	491	305	451	437	785	858	75	-.033	✓ 406.4
	125 15													

BURN RATE AND FLUE GAS DATA
WOOD ...E DATA SHEET #12
WST2-... Rev 1/88
END WT. 512.2 lbs

Unit: KUMA WOOD CLASSIC Date: 9/11/94
Run: EPA 1 Technician(s): A.T.M. & R.L.S.
Page: 3 of 3

Minute / Time	Scale Wt'y	lbs left	Burn Rate	1 CO2 v.	1 CO2 %CO2	2 O2 v.	2 O2 %O2	Tel	3 CO v.	3 CO %CO	Bal	T/C(1)T/C(2) Wet Bulb	T/C(3) Dry Bulb	% H2O	Calc W/B	Stack	4 SO2 v.	SO2 PPM	Static Press.	Comments
240 / 1710	513.4	1.2	0	.217	5.39	55.7	13.91		38.3	1.91	2.8	84	99	3.4	101	197			-.025	Flow
245 / 15	513.3	1.1	.1	.200	4.98	57.6	14.39		37.6	1.88	2.6	84	99	3.4	101	195			-.025	SO2 1.5
250 / 20	513.3	1.1	0	.196	4.88	57.7	14.41		40.1	2.01	2.4	84	99	3.4	101	194			-.025	CO2 1.5
255 / 25	513.2	1.0	.1	.193	4.80	57.8	14.44		41.1	2.05	2.3	84	99	3.4	101	193			-.025	O2 1.5
260 / 30	513.1	.9	.1	.182	4.53	60.2	15.04		33.7	1.70	2.7	83	98	3.3	100	191	Wood	Fell	-.024	CO 1.5
265 / 35	513.1	.9	0	.175	4.36	60.4	15.09		33.8	1.70	2.6	83	98	3.3	100	188	FORWARD		-.023	
270 / 40	513.0	.8	.1	.180	4.48	60.2	15.04		33.2	1.67	2.7	83	98	3.3	100	187			-.022	
275 / 45	513.0	.8	0	.190	4.73	59.2	14.79		30.7	1.65	2.9	83	97	3.3	101	186			-.022	
280 / 50	512.9	.7	.1	.192	4.78	59.0	14.74		33.2	1.68	2.8	83	96	3.3	101	185			-.022	
285 / 55	512.9	.7	0	.191	4.75	59.0	14.74		34.4	1.71	2.8	82	96	3.2	100	184			-.022	
290 / 1800	512.8	.6	.1	.183	4.56	59.5	14.86		37.3	1.86	2.4	82	95	3.2	100	183	Wood Forward	Fell again	-.022	
295 / 05	512.8	.6	0	.184	4.58	60.2	15.04		34.6	1.73	2.6	82	94	3.2	100	182	bright	Cools	-.021	
																2265	LPAD Plugged		-.278	Flow
300 / 10	512.7	.5	.1	.187	4.65	59.9	14.96		31.3	1.58	2.9	81	94	3.1	100	181	No WT Loss		-.022	SO2 1.5
305 / 15	512.7	.5	.0	.182	4.53	60.2	15.04		32.5	1.63	2.8	81	93	3.1	100	181	13:12 mins.		-.022	CO2 1.5
310 / 20	512.7	.5	0	.186	4.63	61.0	15.24		27.5	1.39	3.3	80	93	3.0	100	181	Raked Coals		-.020	O2 1.5
315 / 25	512.6	.4	.1	.208	5.17	58.9	14.71		23.7	1.19	4.3	81	93	3.1	100	187	In Front of		-.023	CO 1.5
320 / 30	512.5	.3	.1	.204	5.07	58.6	14.64		26.8	1.35	3.8	80	92	3.0	100	189	LPAD		-.024	
325 / 35	512.5	.3	0	.197	4.90	59.4	14.84		26.0	1.31	3.7	79	91	2.9	99	188			-.024	
330 / 40	512.4	.2	.1	.187	4.65	60.2	15.04		26.7	1.35	3.4	78	90	2.9	98	187			-.024	
335 / 45	512.4	.2	0	.189	4.70	60.0	14.99		26.7	1.34	3.5	78	89	2.9	97	187			-.024	
340 / 50	512.3	.1	.1	.186	4.63	60.3	15.06		27.2	1.36	3.4	77	89	2.7	95	186			-.024	
345 / 55	512.3	.1	0	.183	4.56	60.6	15.14		28.4	1.43	3.2	77	89	2.7	95	185			-.024	
350 / 1900	512.2	0	.1	.175	4.36	61.9	15.46		27.3	1.41	3.1	77	88	2.7	95	184			-.024	
355 / 05																2036			-.255	
													71+			18140			2.525	
																255			-.0356	

TEMPERATURES
RECORD SHEET #14
WST2-Form14 Rev7/96

Unit: Kuma Wood Classic Date: 9/11/99
Run: EPA 1 Technician(s): ATM, RLS.
Page: 2 of 3

T/C# / Minute / Time	4 Stove Top	5 Left Side	6 Back	7 Right Side	8 Bottom	9 Firebox	10 2nd Burn ~~Catalytic~~	11 Room Temp	12 Tunnel	13 C. Gas Box	14 Impinger Out	15 5G-1 Filter	16 5G-1 Condenser	17 REAR 2nd ~~Con-dor~~	18 Hot Box
120 / 1510	414	528	308	520	376	853	971	77	102	248	40	88	38	1136	248
125 / 15	398	518	305	515	378	844	953	77	101	248	40	88	38	1102	248
130 / 20	387	509	302	510	380	832	932	76	101	248	40	88	38	1091	248
135 / 25	378	500	300	504	382	828	921	76	100	248	40	88	37	968	248
140 / 30	372	493	296	497	384	818	912	77	100	248	40	88	37	950	248
145 / 35	364	485	292	489	385	806	893	77	99	248	38	88	37	931	248
150 / 40	359	478	288	481	386	791	875	76	99	249	37	88	37	929	248
155 / 45	351	470	285	473	387	773	861	76	99	250	36	88	37	928	248
160 / 50	345	463	282	466	388	768	869	76	98	250	36	88	37	916	249
165 / 55	340	457	279	460	388	761	853	76	98	250	36	88	37	919	250
170 / 1600	336	451	276	455	388	747	828	76	98	250	36	89	37	931	250
175 / 05	331	444	274	450	388	733	812	76	98	250	36	89	37	935	250
	(4375)	(5796)	(3487)	(6820)	(4610)	(9549)	(10,680)	(916)							
180 / 10	327	437	272	444	388	722	787	77	97	250	37	89	37	896	250
185 / 15	322	431	270	439	387	711	775	76	97	250	37	89	37	878	250
190 / 20	318	424	268	433	385	708	765	76	97	249	37	89	37	854	250
195 / 25	314	418	265	429	383	697	757	76	97	249	38	89	37	841	250
200 / 30	311	412	263	425	382	693	751	76	96	249	38	89	38	838	250
205 / 35	308	407	261	421	380	687	751	76	96	249	38	89	38	834	250
210 / 40	304	402	258	417	378	686	749	77	96	248	38	89	38	835	249
215 / 45	302	398	256	414	376	684	742	76	95	249	38	89	38	836	250
220 / 50	299	394	255	411	375	681	732	76	95	249	38	89	38	840	249
225 / 55	296	391	256	408	374	684	725	76	95	250	38	89	38	831	249
230 / 1700	294	388	257	404	373	681	713	76	95	250	39	90	38	865	249
235 / 05	291	385	258	400	372	678	706	76	95	250	39	89	38	803	249
	(3686)	(4887)	(3139)	(5045)	(4553)	(8312)	(8953)	(914)							
	8061	10,683	6626	10,865	9163	17,861	19,633	1830							

TEMPERATURES
RECORD SHEET #14
WST2-Form14 Rev7/96

Unit: Kuma Wood Classic Date: 9/11/ 199
Run: EPA 1 Technician(s):
Page: 1 of 3 AFM RLS

Reran 2nd

T/C#	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Minute / Time	Stove Top	Left Side	Back	Right Side	Bottom	Firebox	2nd Burn [redacted]	Room Temp	Tunnel	C. Gas Box	Impinger Out	5G-1 Filter	5G-1 Condenser	[redacted] duct	HOT Box
0 / 1310	348	491	305	457	437	785	858	75	97	248	38	85	52	786	249
5 / 15	339	477	315	440	437	728	985	74	115	248	38	86	37	1111	248
10 / 20	421	468	305	430	436	670	940	75	107	248	38	87	37	721	248
15 / 25	428	464	300	416	431	657	1318	75	104	249	39	88	37	926	249
20 / 30	432	448	296	411	426	668	1366	75	104	250	39	88	37	910	249
25 / 35	460	445	293	410	419	691	1397	75	104	250	39	88	37	900	249
30 / 40	489	445	290	414	412	720	1489	75	106	250	39	88	37	1000	250
35 / 45	530	465	276	426	405	756	1557	75	106	250	40	88	37	1021	249
40 / 50	573	465	266	437	398	788	1575	75	108	250	40	88	37	1012	249
45 / 55	604	477	259	450	393	820	1596	76	109	250	40	88	37	1036	249
50 / 1400	617	488	255	463	388	840	1518	76	109	250	40	88	38	1069	249
55 / 05	613	497	255	476	383	862	1466	76	110	250	40	88	38	1107	249
	5844	5610	3415	5724	4965	8985	16,065	902							
60 / 10	610	505	257	490	380	876	1432	77	110	250	40	88	38	1113	249
65 / 15	608	511	259	500	377	888	1434	77	110	249	40	88	38	1131	249
70 / 20	608	518	262	509	375	902	1386	76	110	248	40	88	38	1146	248
75 / 25	609	527	266	517	373	941	1396	76	110	248	40	88	38	1280	248
80 / 30	609	534	271	522	372	988	1446	76	110	248	40	88	38	1253	248
85 / 35	601	545	277	525	371	1085	1386	77	109	248	40	88	38	1292	248
90 / 40	575	554	285	527	370	1048	1261	77	108	249	40	88	38	1323	248
95 / 45	553	557	293	527	369	952	1213	77	107	249	40	88	38	1353	248
100 / 50	522	556	299	526	369	927	1130	77	106	249	40	88	38	1342	248
105 / 55	481	553	306	524	370	908	1056	77	105	249	40	88	38	1345	248
110 / 1500	454	547	310	523	372	889	1016	77	104	249	40	88	38	1277	248
116 / 05	430	538	310	522	374	863	986	77	103	248	40	88	38	1182	248
	6660	6445	3395	6212	4472	11,267	15,142	921							
	12,504	12,055	6810	11,436	9437	20,252	31,207	1823							

TEMPERATURES
RECORD SHEET #14
WST2-Form14 Rev7/96

Test: KUMA WOOD CLASSIC Date: 9/11/99
Run: EPA1 Technician(s): ATM, DLS.
Page: 3 of 3

T/C# / Minute / Time	4 Stove Top	5 Left Side	6 Back	7 Right Side	8 Bottom	9 Firebox	10 2nd Burn Catalytic	11 Room Temp	12 Tunnel	13 C. Gas Box	14 Impinger Out	15 5G-1 Filter	16 5G-1 Condenser	17 REAR 2nd ~~Condor~~	18 HOT BOX	
240 1710	290	382	259	396	371	676	699	77	94	250	39	89	38	788	249	
245 15	287	380	259	392	370	662	689	76	94	250	39	89	38	768	249	
250 20	285	376	258	387	369	656	683	76	94	250	39	89	38	761	249	
255 25	282	374	256	383	368	653	677	77	94	251	39	89	38	761	249	-73.8
260 30	279	369	254	379	366	629	668	76	94	251	39	89	38	716	247	
265 35	276	365	250	376	365	620	661	75	93	250	39	88	38	716	244	-80.2
270 40	273	361	248	372	362	621	650	75	93	249	39	88	38	705	242	
275 45	270	357	246	369	360	623	646	75	92	249	39	88	38	717	241	
280 50	267	353	246	366	358	622	642	75	92	248	39	88	38	729	242	
285 55	266	351	246	365	357	626	638	75	91	247	39	88	38	728	242	
290 1800	263	348	246	362	357	619	633	75	90	246	40	87	38	717	242	-91.2
295 05	262	346	245	360	356	613	628	75	90	246	39	87	38	700	241	
	33800	43624	30613	45074	43594	76204	79144	9078								
300 10	259	343	243	358	354	610	626	75	89	245	40	86	37	739	240	
305 15	258	341	241	355	353	608	624	75	89	244	39	86	38	740	239	-96.8
310 20	256	339	239	353	354	605	705	74	90	244	39	85	38	669	239	
315 25	261	338	236	350	354	589	746	74	89	243	40	85	38	636	239	
320 30	265	336	231	347	352	579	750	73	88	243	40	85	39	627	239	-100.2
325 35	267	335	226	344	348	576	724	74	88	243	40	84	38	628	238	
330 40	266	334	221	342	345	569	704	74	87	242	40	84	39	622	237	
335 45	266	332	217	339	341	566	729	74	87	242	40	84	39	617	237	-109.4
340 60	267	331	212	335	336	564	709	74	87	241	40	84	39	613	237	-110.2
345 55	265	332	209	332	333	559	699	74	87	241	40	83	39	606	236	
350 1900	264	329	207	331	331	550	676	73	86	241	40	83	39	597	236	
355 05	28940	36960	24820	37860	38010	63774	76924	8140			DELTA T	START	406.4			
	26759	30398	18931	30594	26760	52110	66446	5374		÷ 71		STOP	292.4			
	377	434	267	431	377	734	936	76					-114.0			

AT

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-1

Site: Myren Consulting, Woodinville, WA Date: 9/11/99 Analyte: CO_2

Source: Kuma Wood Classic Run #: EPA 1

Zero Cyl #: 719 430 Conc. 00.0 % CO_2 Cyl Press: 1860 psi

Certified by: Oxarc Date: 4/1/99

Span Cyl #: 250-794 Conc. 12.5 % CO_2 Cyl Press: 1325 psi

Certified by: Oxarc Date: 3/26/99

Analyzer: Make: Horiba Model: PIR-2000 SN: 607024

Range: 0 - 25.0% CO_2 Analyzer Output: 0 - 1.0 v.

Flow: 1.5 SCFH Measured by: Rotameter: X Flowmeter:

EPA Span Value = 25.0% CO_2
EPA Control Limits = ± 2.5% of 25.0% CO_2 = ± 0.625% CO_2

Pre Run Audit: By: RLS Time: 1145 Temp: 75 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	.000	00.0	00.0	.000	.0446	.0446	+0.18
Span	50.0	.500	12.5	49.8	.499	12.3465	-.1535	-1.23

Comments:

Post Run Audit: By: A.T.Myren Time: 1955 Temp: 77 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	.000	00.0	00.0	.000	.0446	.0446	+0.18
Span	50.0	.500	12.5	49.25	.499	12.3465	-.1535	-1.23

Comments:

± Conc. Difference = Act % - Exp (Std) %

Zero % Differece = $\frac{\text{Act \% (ppm)} - \text{Exp \% (ppm)}}{\text{Full Scale Value}} \times 100$

Span % Difference = $\frac{\text{Act \% (ppm)} - \text{Exp \% (ppm)}}{\text{Exp \% (ppm)}} \times 100$

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-2

Site: Myren Consulting, Woodinville, WA Date: 9/11/99 Analyte: O_2

Source: Kuma Wood Classic Run #: EPA 1

Zero Cyl #: 719 480 Conc. 00.0 % O_2 Cyl Press: 1860 psi

Certified by: Oxarc Date: 4/1/99

Span Cyl #: 250-794 Conc. 12.5 % O_2 Cyl Press: 1325 psi

Certified by: Oxarc Date: 3/26/99

Analyzer: Make: Taylor Model: OA 137 SN: 137/4772

Range: 0 - 25.0% O_2 Analyzer Output: 0 - 100 mv.

Flow: 1.5 SCFH Measured by: Rotameter: X Flowmeter:

EPA Span Value = 25.0% O_2
EPA Control Limits = + 2.5% of 25.0% O_2 = + 0.625% O_2

Pre Run Audit: By: RLS Time: 1145 Temp: 75 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	00.0	00.0	.0050	+.0050	+0.02
Span	12.5	50.0	12.5	12.5	50.0	12.490%	-.0092	-0.07

Comments:

Post Run Audit: By: RL, Myren Time: 1955 Temp.: 77 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	00.0	00.0	.0050	+.0050	+002
Span	12.5	50.0	12.5	12.5	49.9	12.465%	-.03421	-0.27

Comments:

± Conc. Difference = Act % - Exp (Std) %

$$\text{Zero \% Differece} = \frac{\text{Act \% (ppm)} - \text{Exp \% (ppm)}}{\text{Full Scale Value}} \times 100$$

$$\text{Span \% Difference} = \frac{\text{Act \% (ppm)} - \text{Exp \% (ppm)}}{\text{Exp \% (ppm)}} \times 100$$

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-3

Site: Myren Consulting, Woodinville, WA Date: 9/11/99 Analyte: CO

Source: Kuma Wood Classic Run #: EPA 1

Zero Cyl #: 719 430 Conc. 00.0 % CO Cyl Press: 1860 psi

Certified by: Oxarc Date: 4/1/99

Span Cyl #: 250-794 Conc. 2.50 % CO Cyl Press: 1325 psi

Certified by: Oxarc Date: 3/26/99

Analyzer: Make: Infra Red Model: 702 D SN: 113

Range: 0 - 10.0% CO Analyzer Output: 0 - 100 mv.

Flow: 1.5 SCFH Measured by: Rotameter: X Flowmeter:

EPA Span Value = 5.0% CO

EPA Control Limits = +2.5% of 5.0% CO = + 0.125% CO

Pre Run Audit: By: RLS Time: 1145 Temp: 75 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	0.00	00.0	.0093	-.0093	-0.19
Span	2.50	50.0	2.50	2.50	50.0	2.4914	-.0086	-0.34

Comments:

Post Run Audit: By: A.T. Myrum Time: 1955 Temp.: 77 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	0.00	00.0	.0093	-.0093	-0.19
Span	2.50	50.0	2.50	2.50	49.9	2.4864	-0.0136	-0.54

Comments:

± Conc. Difference = Act % - Exp (Std) %

Zero % Differece = $\frac{\text{Act \% (ppm)} - \text{Exp \% (ppm)}}{\text{Full Scale Value}} \times 100$

Span % Difference = $\frac{\text{Act \% (ppm)} - \text{Exp \% (ppm)}}{\text{Exp \% (ppm)}} \times 100$

Unit: Kuma Wood Classic
Run: EPA 1
Date: 9/11/199
Technicians: ATM / RLS
WST6-Form3-Rev11/89

QUALITY CHECKS
WOODSTOVE DATA SHEET #16

Ambient = Tr: _____ °F T/C#30: _____ °F

Thermocouple Check (at ambient): T/C#1: 65 °F; T/C#2: 65 °F;

T/C #3: 65 °F; T/C #4: 66 °F; T/C #5: 66 °F;

T/C #6: 66 °F; T/C #7: 66 °F; T/C #8: 66 °F;

T/C #9: 66 °F; T/C #10: 67 °F; T/C #11: 67 °F;

T/C #12: 66 °F; T/C #13: 66 °F; T/C #14: 67 °F;

T/C #15: 66 °F; T/C #16: 66 °F; T/C #17: 65 °F;

T/C #18: _____ °F; T/C #19: _____ °F; T/C #20: _____ °F;

T/C #21: _____ °F; T/C #22: _____ °F; T/C #23: _____ °F;

T/C #24: _____ °F; T/C #25: _____ °F; T/C #26: _____ °F;

Comments: _____

Thermocouple Readout: Pretest Zero/Span Check and Calibration:

Zero (0°F): 002 °F Adj to: 000 °F Post Test Check Zero (0°F): 001 °F % Difference +0.05 %

Span (2000°F): 2000 °F Adj to: 2000 °F Span (2000°F): 2000 °F 0.00

(Allowable % Difference = 1.5%. Use formulas on Woodstove Data Sheet #15 to calculate % Difference)

Thermocouple Readout Pretest Linearity Check

0°F = 000 °F; 200°F = 200 °F; 400°F = 401 °F;

600°F = 600 °F; 800°F = 800 °F; 1000°F = 1001 °F;

1200°F= 1201 °F; 1400°F = 1400 °F; 1600°F = 1600 °F

1800°F= 1800 °F; 2000°F = 2000 °F

Combustion Gas (CO_2,O_2,CO) Train Leak Check: Pre ✓ Post ✓ ok ATM

Draft (Static) Guage Zero Check: Pre ✓ Post ____

Scale Check Pre (Wt, #'s): 570.7 - 575.7 5.0 lbs (OK) RLS.

Post (Wt, #'s): 517.0 - 512.0 5.0 lbs / 5.0 lbs Ok ATM

Stack cleaned prior to the run: Yes ✓ No ____

Tunnel cleaned prior to the run: Yes ✓ No ____

DILUTION TUNNEL CALCULATIONS

MYREN CONSULTING CERTIFICATION TEST DATA

3/31/96

File Name:	KuamEPA2
Stove Manufacturer:	Kuma
Model Number:	Wood Classic
Lab Name:	MYREN
Test Date:	9\13\99
Run Number:	EPA 2
Meter Box Y Factor:	1.0151
Barometric pressure (in):	28.7214
Gas meter temp (ave):	91
delta H(avg):	0.900
Gas meter initial reading:	551.000
Gas meter final reading:	732.230
Front catch (acetone) mg:	5.9
first filter catch (mg):	26.6
second filter catch (mg):	1.4
tunnel flow (ave cfm):	142.556
Emission Rate(g/hr):	1.735
Emission Rate(M5H) :	2.876
vs/VmTs:	0.0088
vs ave:	842.157
Tunnel average temp (°f):	104.029
Test time(min):	325
Fuel Load(lb. wet):	14.6
Wood moisture(%wet):	17.632
Burn rate(dry kg/hr):	1.007
Samp vol(scf):	169.520
front filter number	932
back filter number	825
acetone beaker number	25
PRELIMINARY RESULTS	
FINAL RESULTS	AUDITED
DATA SUMMARY	
MODEL :	Wood Classic
RUN:	EPA 2
DATE:	9\13\99
DBR:	1.007
GPH UNADJ	1.735
ADJ	2.875732785

RUN TIME (min)	PITOT DELTAP (- INCH H20)	TNL TEMP (°F)	GAS METER RDG (ft3)	GAS METER TEMP (°F)	GAS METER DELTA H (in.H2O)	TUNNEL VELOCIT (ft/min)	PROP RATE (%)	dDGM vol std (ft3)
0	0.040	99	551.000	78	0.900	838.41		
10	0.040	114	556.552	79	0.900	849.58	104.1	5.310
20	0.040	110	562.102	81	0.900	846.62	101.6	5.288
30	0.040	114	567.625	83	0.900	849.58	101.8	5.243
40	0.040	114	573.156	85	0.900	849.58	101.2	5.231
50	0.040	114	578.680	86	0.900	849.58	100.9	5.215
60	0.040	116	584.233	87	0.900	851.06	101.6	5.233
70	0.040	116	589.775	88	0.900	851.06	101.0	5.213
80	0.040	114	595.328	89	0.900	849.58	100.7	5.214
90	0.040	113	600.904	90	0.900	848.84	100.9	5.226
100	0.040	110	606.491	91	0.900	846.62	100.5	5.227
110	0.040	108	612.059	92	0.900	845.13	99.9	5.200
120	0.040	106	617.655	92	0.900	843.64	100.2	5.226
130	0.040	105	623.240	92	0.900	842.90	100.0	5.216
140	0.040	104	628.837	92	0.900	842.15	100.1	5.227
150	0.040	103	634.427	92	0.900	841.40	99.9	5.220
160	0.040	102	640.022	93	0.900	840.66	99.7	5.215
170	0.040	102	645.622	93	0.900	840.66	99.9	5.220
180	0.040	101	651.220	93	0.900	839.91	99.7	5.218
190	0.040	101	656.819	93	0.900	839.91	99.8	5.219
200	0.040	100	662.428	94	0.900	839.16	99.6	5.219
210	0.040	100	668.030	94	0.900	839.16	99.6	5.212
220	0.040	100	673.628	94	0.900	839.16	99.5	5.209
230	0.040	100	679.227	94	0.900	839.16	99.5	5.210
240	0.040	99	684.811	94	0.900	838.41	99.1	5.196
250	0.040	99	690.383	94	0.900	838.41	99.0	5.185
260	0.040	99	695.961	94	0.900	838.41	99.1	5.190
270	0.040	98	701.542	95	0.900	837.66	98.8	5.184
280	0.040	98	707.115	94	0.900	837.66	98.9	5.186
290	0.040	97	712.694	94	0.900	836.91	98.8	5.191
300	0.040	96	718.276	94	0.900	836.16	98.8	5.194
310	0.040	96	723.855	94	0.900	836.16	98.8	5.191
320	0.040	95	729.425	94	0.900	835.40	98.5	5.183
325	0.040	94	732.230	94	0.900	834.65	99.1	2.610
						0.00	0.0	0.000
350						0.00	0.0	0.000

METHOD 5G-1 PARTICULATE SAMPLING DATA Kuma LAB-

DATE 9/13/1999 PAGE 1 OF 2 MODEL # Wood Classic RUN # EPA 2

METER BOX # 511-M METER Y 1.0151 FILTER # (F) 932 (R) 825

PRE TEST LEAK RATE = .000 CFM @ -15.75 IN. HG, 656/,656 FILTER SIZE: 110 mm

POST TEST LEAK RATE = .000 CFM @ -14.50 IN. HG .063/.063 PROBE LENGTH 24" glass

TIME		METER READING CU.FT.	PITOT dp	TNL TEMP. (°F)	METER TEMP. (°F)	GAS METER dh	VAC IN. Hg
CLOCK	ELAPSED						
1325	00	551.000	.040	99	78	.90	0
35	10	556.552	.040	114	79	.90	0
45	20	562.102	.040	110	81	.90	0
55	30	567.625	.040	114	83	.90	0
1305	40	573.156	.040	114	85	.90	0
15	50	578.680	.040	114	86	.90	0
25	60	584.233	.040	116	87	.90	0
35	70	589.775	.040	116	88	.90	0
45	80	595.328	.040	114	89	.90	0
55	90	600.904	.040	113	90	.90	0
1405	00	606.491	.040	110	91	.90	0
15	10	612.059	.040	108	92	.90	0
25	20	617.655	.040	106	92	.90	0
35	30	623.240	.040	105	92	.90	0
45	40	628.837	.040	104	92	.90	0
55	50	634.427	.040	103	92	.90	0
1505	60	640.022	.040	102	93	.90	0
15	70	645.622	.040	102	93	.90	0
25	80	651.220	.040	101	93	.90	0
35	90	656.819	.040	101	93	.90	0

VELOCITY TRAVERSE

POINT	LOCATION	ΔP	TEMP
N-1	0.5"	.040	103
2	1.5"	.040	103
3	4.5"	.040	104
4	5.5"	.036	104
W-1	0.5"	.038	104
2	1.5"	.041	104
3	4.5"	.040	104
4	5.5"	.037	104
	Avg.	.039	103.750

Pilot Leak Check Pre ✓ Post ✓

Cp = 0.99

N
1
2
W 1 2 3* 4
3
4

*=point of Avg. delta p

$Qs = \left(\sqrt{\frac{\Delta P \times BP}{T(°R)}}\right) \times 3167.2 =$

141.297 cfm

BP = ~~START~~ 28.77 in Hg

60	28.75
120	28.74
180	28.72
240	28.70
300	28.69
325	28.68
$\bar{X}$ =	28.7214 ✓

27.4 17

METHOD 5G — PARTICULATE SAMPLING DATA — LAB-

DATE 9/13/99 PAGE 2 OF 2 MODEL # KUMA 2000 CLASSIC RUN # EPA 2

METER BOX # 511M METER Y 1.0157 FILTER # (F) 832 (R) 835

PRE TEST LEAK RATE = .000 CFM @ -15.75 IN. HG .656/.656 FILTER SIZE: 110 MM

POST TEST LEAK RATE = .000 CFM @ -14.50 IN. HG .063/.063 PROBE LENGTH 24" Glass

TIME		METER READING CU.FT.	PITOT dp	TNL TEMP. (°F)	METER TEMP. (°F)	GAS METER dh	VAC IN. Hg
CLOCK	ELAPSED						
1545	00	662.478	.040	100	94	.90	0
55	10	668.030	.040	100	94	.90	0
1605	20	673.628	.040	100	94	.90	0
15	30	679.227	.040	100	94	.90	0
25	40	684.811	.040	99	94	.90	0
35	50	690.383	.040	99	94	.90	0
45	60	695.961	.040	99	94	.90	0
55	70	701.542	.040	98	95	.90	0
1705	80	707.115	.040	98	94	.90	0
15	90	712.694	.040	97	94	.90	0
25	00	718.276	.040	96	94	.90	0
35	10	723.855	.040	96	94	.90	0
45	20	729.425	.040	95	94	.90	0
1750	30	732.230	.040	94	94	.90	0
1805	40	181.230					
15	50						
25	60						
35	70						
45	80						
55	90						

VELOCITY TRAVERSE

POINT	LOCATION	Δp	TEMP
N-1	0.5"	.040	103
2	1.5"	.040	103
3	4.5"	.040	104
4	5.5"	.036	104
W-1	0.5"	.038	104
2	1.5"	.041	104
3	4.5"	.040	104
4	5.5"	.037	104
	Avg.	.039	103.75

Pilot Leak Check Pre ✓ Post ✓

Cp = 0.99

N
1
2
→ W 1 2 (3*)
3
4

*=point of Avg. delta p

$Qs = \left(\sqrt{\frac{\Delta P \times BP}{T(°R)}}\right) \times 3167.2 =$

141.297 cfm

BP = ~~Start~~ 28.72 in Hg

60 28.75
120 28.74
180 28.72
240 28.73
300 28.69
325 28.68

$\bar{X} = 28.7214$

WOODSTOVE DATA SHEET #4-1: INITIAL FILTER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date 1/8/99 Time 12:00 By ATM Front Half ✓ Back Half ✓

Manufacturer: Schleicher & Schuell Size: 11 cm Lot.No.: ZB951 Grade: #25 Glass
Order No. 06220

Filter #	First Wt	Date	Time	By	Second Wt	Date	Time	By	Third Wt	Date	Time	By
801	.7864	1/8/99	1710	Om.	.7867	7/18/99	1747	ATM				
802	.8101		1111	om	.8106		1746	ATM				
803	.7927		1112	om	.7931		1744	ATM				
804	.7988		1113	" "	.7993		1743	ATM				
805	.7836		1114	" "	.7839		1742	ATM				
806	.7758		1115		.7762		1741	ATM				
807	.7948		1116		.7951		1740	ATM				
808	.8028		1117		.8031		1739	ATM				
809	.8098		1118		.8100		1738	ATM				
810	.8120		1119		.8124		1737	ATM				
811	.8093		1120		.8096		1736	ATM				
812	.7992		1121		.7995		1734	ATM				
813	.7832		1122		.7835		1733	ATM				
814	.7820		1123		.7823		1732	ATM				
815	.7949		1124		.7952		1731	ATM				
816	.8229		1125		.8232		1730	ATM				
817	.8129		1340		.8129		1729	ATM				
818	.8157		1341		.8159		1728	ATM				
819	.8001		1342		.8003		1727	ATM				
820	.7967		1343		.7967		1726	ATM				
821	.7980		1344		.7978		1725	ATM				
822	.7868		1345		.7871		1724	ATM				
823	.8039		1346		.8039		1722	ATM				
824	.7843		1347		.7843		1721	ATM				
825	.7811	✓	1348	✓	.7811	✓	1720	ATM				

Checked by A.T. Rupp Date: 7/29/99 Time 0900

QA REWEIGH

Filter #	WT	Date	Time	By
801	.7863	7/22/99	2150	JW
809	.8100	7/22/99	2151	JW
819	.8002	7/22/99	2152	JW

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
49	72	45	6/19/99	1050	ATM
63	77	45	7/18/99	1604	ATM
64	80	41	7/22/99	2145	ATM

Post Weighing Session Scale Check

	1st	2nd	3rd
0.0000	.0000	.0001	.0000
1.0000	1.0001	1.0001	1.0000

WOODSTOVE DATA SHEET #4-1: INITIAL FILTER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date 1/9/99 Time 1445 By ATM Front Half ✓ Back Half ✓

Manufacturer: Schleicher & Schuell Size: 11cm Lot.No.: Z8961 Grade: #25 Glass
Order No: 06220

Filter #	First Wt	Date	Time	By	Second Wt	Date	Time	By	Third Wt	Date	Time	By
926	.7740	3/6/99	1140	T.M.	.7739	3/15/99	1652	ATM				
927	.7838		1141	T.M.	.7938		1651	ATM				
928	.7985		1142	T.M.	.7985		1650	ATM				
929	.7909		1143	T.M.	.7912		1649	ATM				
930	.7948		1144	T.M.	.7950		1648	ATM				
931	.8041		1145	T.M.	.8042		1647	ATM				
932	.7917		1146	T.M.	.7918		1646	ATM				
933	.8047		1147	T.M.	.8048		1645	ATM				
* 934	.7981		1148	T.M.	.7918		1644	ATM	.7917	3/16/99	2130	JW
935	.7861		1149	T.M.	.7861		1643	ATM				
936	.7827		1150	T.M.	.7828		1643	ATM				
937	.7935		1151	T.M.	.7933		1642	ATM				
938	.8086		1152	TM	.8084		1641	ATM				
939	.8060		1153	TM	.8058		1640	ATM				
940	.8151		1154	TM	.8151		1639	ATM				
941	.8252		1155	TM	.8249		1638	ATM				
942	.7982		1156	TM	.7983		1637	ATM				
943	.7822		1157	TM	.7822		1636	ATM				
* 944	.7938		1158	TM	.7968		1635	ATM	.7968	3/16/99	2131	JW
945	.7944		1159	TM	.7943		1635	ATM				
946	.7859		1200	TM	.7850		1634	ATM				
947	.7731		1201	TM	.7735		1633	ATM				
948	.7936		1202	TM	.7940		1632	ATM				
949	.7838		1203	TM	.7837		1631	ATM				
950	.8040		1204	TM	.8038		1630	ATM				

Checked by JW Date: 3/16/99 Time 2133

QA REWEIGH

Filter #	WT	Date	Time	By
929	.7912	3/16/99	2136	JW
941	.8248	3/16/99	2134	JW
949	.7837	3/16/99	2133	JW

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
64	79	43	3/6/99	1135	ATM
66	81	45	3/15/99	1622	ATM
65	82	39	3/16/99	2025	ATM

Post Test Weighing Session Scale Check

1st	2nd	3rd	QC
0.0000	0.0000	0.0000	Δ.0001
1.0000	1.0000	1.0000	0.9999

WOODSTOVE DATA SHEET #4-2:
INITIAL BEAKER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date: 8/20/99 Time: 1500 By: A.T.Myren

	Beaker #	First Wt	Date	Time	By	Second Wt	Date	Time	By	Third Wt	Date	Time	By
Glass	1	65.4841	8/27	2059	JM	65.4835	8/30/99	1211	ATM				
	2	66.1509	8/27	2118	JM	66.1514		1204	ATM				
	3	67.8582		2116	JM	67.8578		1207	ATM				
	4	67.5890		2108	JM	67.5891		1210	ATM				
	6	67.4270		2119	JM	67.4274		1213	ATM				
	7	65.5444		2105	JM	65.5446		1220	ATM				
	8	66.0219		2121	JM	66.0218		1205	ATM				
	9	66.9297		2120	JM	66.9296		1215	ATM				
	10	66.0906		2114	JM	66.0902		1209	ATM				
	11	65.7072		2112	JM	65.7020		1217	ATM	65.7028	9/8/99	1717	JM
	13	57.8946	↓	2110	JM	57.8948	↓	1218	ATM				
										65.7021	9/11	1232	ATM
										65.7022	9/13	1934	JM
SS	20	73.3159	8/27	2125	JM	73.3160	8/31/99	1320	ATM				
	21	71.0002	8/27	2126	JM	71.0003	↓	1325	ATM				
	22	71.8322	9/11/99	1240	ATM	71.8322	9/13	1719	JM				
	23	70.7376	8/27	2131	JM	70.7382	8/30/99	1259	ATM	70.7376	9/8	1715	JM
	24	73.2173	8/27	2130	JM	73.2182		1301	ATM	73.2176	9/8	1713	JM
	25					72.6505	↓	1257	ATM	72.6504	9/8	1716	JM
	26	71.7865	8/27	2132	JM	71.7868	8/31/99	1322	ATM				
	27	72.3294	9/11/99	1235	ATM	72.3294	9/8	1718	JM				
	28	70.5955	8/27	2127	JM	70.5956	8/31/99	1324	ATM				
	29	71.5183	8/27	2133	JM	71.5185	↓	1318	ATM				
	30	70.7845	8/27	2128	JM	70.7855	8/30/99	1302	ATM	70.7851	9/8	1714	JM
	31	69.6652	8/27	2129	JM	69.6655	8/31/99	1327	ATM				
cont. 23	23	70.7375	9/11	1239	ATM								
cont 24	24	73.2175	9/11	1242	ATM								

Checked By: A.T.Myren Date: 9/11&13/99 Time: ATM

QA REWEIGH

Beaker #	WT	Date	Time	By

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
68	83	46	8/27/99	2052	ATM
67	81	48	8/30/99	1154	ATM
63	76	48	8/31/99	1310	ATM
70	84	47	9/9/99	1705	ATM
69	84	46	9/11/99	1202	ATM
74	77	49	9/13/99	1926	ATM

WOODSTOVE DATA SHEET #4-2:
INITIAL BEAKER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date: 6/1/99 Time: 1400 By: A.T.Myren

Beaker #	First Wt	Date	Time	By	Second Wt	Date	Time	By	Third Wt	Date	Time	By
1	66.4847	7/17/99	1636	OBM	65.4847	7/18/99	1612	ATM	← B KAN	K		
2	66.1504		1638	OBM	66.1506	↓	1614	ATM	7/	13/99		
3	67.8572		1640	OBM	67.8567	↓	1616	ATM				
4	67.5891		1642	OBM	67.5880	↓	1618	ATM				
6	67.4268		1644	OBM	67.4266	↓	1620	ATM				
7	65.5436		1648	OBM	65.5437	↓	1622	ATM				
8	66.0212		1650	OBM	66.0211	↓	1623	ATM				
9	66.6294		1652	OBM	66.6295	↓	1625	ATM				
10	66.0889		1654	OBM	66.0886	↓	1627	ATM				
11	65.7015		1656	OBM	65.7013	↓	1628	ATM				
12	56.0655		1658	OBM	56.0653	↓	1632	ATM				
13	57.8948		1700	OBM	57.8944	↓	1630	ATM				

Checked By: A.T.Myren Date: 7/18/99 Time: 1800

QA REVIEW

Beaker #	WT	Date	Time	By

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
65	78	49	7/17/99	1825	ATM
63	77	45	7/18/99	1604	ATM

WOODSTOVE DATA SHEET #4-3: CONSTANT FINAL WEIGHTS

WST5-Form9, rgl, Rev4/90
Unit Kuma Wood Classic
Run # EPA 2
Date: 9/13/99

FINAL BEAKER WEIGHTS

Beaker #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
25	✓	9/15/99	0810	ATM	72.6563	9/16	0851	ATM	72.6563	9/18	1515	TM				

FINAL FILTER WEIGHTS

Filter #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
(F) 932	.8192	9/13	1820	ATM	.8187	9/14	2040	ATM	.8188	9/17	2059	TM	.8184	9/18	1255	ATM
(F) 825	.7828	9/13	1820	ATM	.7827	9/14	2042	ATM	.7826	9/17/99	2055	TM	.7825	9/18	1250	ATM

QA REWEIGH: FINAL WEIGHTS

Date	Beaker #	Final Wt	By

Date	Filter #	Final WT	By

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	1999 Date	Time	By	WB	DB	%RH
1	9/14	2025	ATM	68	84	44
2	9/16	0845	ATM	69	84	44
3	9/17	2045	ATM	66	79	49
4	9/18	1217	ATM	65	78	48
5						

SCALE ROOM ENVIRONMENTAL CONDITIONS

6						
7						
8						
9						

Comments

WOODSTOVE DATA SHEET #4-3: CONSTANT FINAL WEIGHTS

Blank
7/18/99

WST5-Form9, rg1, Rev4/99
Unit Kuma Wood Classic
Run #
Date: 7/ 199

FINAL BEAKER WEIGHTS

Beaker #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
1	✓	7/21/99	1435	ATM	65.4852	8/4/99	1715	ATM	65.4846	8/8/99	1742	UBH	65.4847	8/9	1642	ATM

FINAL FILTER WEIGHTS

Filter #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By

QA REWEIGH: FINAL WEIGHTS

Date	Beaker #	Final Wt	By
Date	Filter #	Final WT	By

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	1999 Date	Time	By	WB	DB	%RH
1	8/4	1705	ATM	69	83	49
2	8/8	1700	ATM	64	78	46
3	8/9	1615	ATM	69	84	46
4						
5						

SCALE ROOM ENVIRONMENTAL CONDITIONS

6						
7						
8						
9						

Comments

Dates From 1/9/99

Through 7/17/99

WOODSTOVE DATA SHEET #4-4
SCALE QA SHEET

Scale Mettler
Model AE100
SN K04827

Level	Recalibrated	100g Weight	10g Weight	1.0g Weight	100mg Weight	20mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
V	Yes P.O.	99.9999	10.0001	1.0002	.1003	.0203	1/9/99	1243	ATM	58	70	48
V	No	100.0002	10.0000	1.0000	.1000	.0200	1/14/99	1113	ATM	62	75	47
V	YES P.O.	99.9998	10.0002	1.0000	.0999	.0201	1/23/99	1100	ATM	63	77	48
V	YES	99.9999	10.0000	1.0000	.1000	.0201	1/24/99	1318	ATM	59	74	45
V	YES	99.9996	10.0002	1.0000	.1000	.0200	2/1/99	0910	ATM	55	69	39
V	YES	99.9997	10.0001	1.0001	.1002	.0201	2/2/99	0939	ATM	60	73	46
V	YES	99.9999	10.0001	1.0001	.1001	.0200	2/3/99	1555	ATM	63	76	48
V	YES	99.9999	10.0000	1.0001	.1001	.0201	2/7/99	1235	ATM	62	76	45
V	YES	99.9998	10.0000	1.0000	.1000	.0200	2/10/99	1600	ATM	63	77	45
V	YES	99.9998	10.0000	1.0001	.1000	.0200	2/19/99	0246	ATM	64	78	46
V	NO	99.9999	10.0000	1.0000	.1000	.0200	2/21/99	1313	ATM	65	80	44
V	NO	99.9997	10.0000	1.0001	.1000	.0200	3/5/99	1935	ATM	64	80	41
V	YES P.O.	99.9997	10.0000	1.0000	.1001	.0200	3/6/99	1135	ATM	64	79	43
V	YES	99.9997	10.0000	1.0001	.1000	.0200	3/13/99	1526	ATM	65	80	44
V	YES	99.9999	10.0001	1.0001	.1001	.0200	3/14/99	1355	ATM	63	78	43
V	NO	100.0001	10.0000	1.0000	.1000	.0200	3/15/99	1622	ATM	66	81	45
V	Yes	99.9997	10.0000	1.0001	.1000	.0200	3/16/99	2025	ATM	65	82	39
V	yes	99.9996	10.0000	1.0001	.1001	.0200	3/17/99	1615	ATM	62	77	42
V	yes	99.9997	10.0000	1.0001	.1000	.0200	3/18/99	2140	ATM	68	84	43
V	yes	99.9998	10.0000	1.0000	.1000	.0200	3/20/99	1300	ATM	64	84	32
V	yes	99.9999	10.0000	1.0001	.1001	.0201	3/21/99	2215	ATM	61	74	47
V	yes	99.9997	10.0000	1.0000	.1001	.0200	3/22/99	0102	ATM	65	85	33
V	yes	99.9997	10.0000	1.0001	.1000	.0200	3/23/99	1115	ATM	69	84	46
V	yes	99.9998	10.0000	1.0002	.1001	.0201	3/24/99	1120	ATM	72	89	43
V	yes	99.9999	10.0000	1.0002	.1001	.0201	3/29/99	2038	ATM	69	92	45
V	No	99.9999	10.0002	1.0002	.1001	.0202	3/30/99	0610	ATM	66	80	47
V	No	99.9999	10.0000	1.0000	.1001	.0201	3/31/99	1000	ATM	64	80	41
V	NO	99.9996	10.0000	1.0000	.1001	.0201	4/5/99	1730	ATM	64	80	41
V	Yes	99.9998	10.0001	1.0001	.1001	.0201	4/6/99	1030	ATM	61	75	44
QC Services	Audit	4/6/97	— wt. / Scale check after audit									
V	NO	100.0003	10.0001	1.0001	.1001	.0201	4/6/99	1730	ATM			
V	YES	99.9998	10.0001	1.0001	.1001	.0200	4/7/99	1724	ATM	65	85	33
V	NO	99.9996	10.0000	1.0001	.1001	.0201	4/8/99	1346	ATM	67	80	50
V	YES	99.9997	10.0000	1.0000	.1000	.0200	4/16/99	1230	ATM	66	82	43
V	YES	99.9997	10.0000	1.0000	.1000	.0200	4/17/99	1625	ATM	68	84	43
V	No	99.9999	10.0000	.9998	.0999	.0198	6/9/99	1050	ATM	49	72	45
V	yes	99.9996	10.0001	1.0002	.1001	.0202	7/17/99	1825	ATM	65	78	49

WOODSTOVE DATA SHEET #4-4
SCALE QA SHEET

Dates From 7/18/99
Through 9/16/99

Scale Mettler
Model AE100
SN K04827

Level	Recalibrated	100g Weight	10g Weight	1.0g Weight	100mg Weight	20mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	No	99.9996	10.0000	1.0001	.1000	.0201	7/18/99	1604	ATM	63	77	45
✓	YES	99.9997	10.0000	1.0001	.1001	.0201	7/19/99	1835	ATM	64	77	49
✓	Yes	99.9996	10.0000	1.0002	.1002	.0202	7/20/99	1854	ATM	71	85	80
✓	Yes	99.9997	10.0001	1.0001	.1001	.0201	7/21/99	1306	ATM	69	84	50
✓	Yes P.O.	99.9996	9.9999	1.0000	.1000	.0200	7/22/99	2145	ATM	64	80	41
✓	Yes	99.9998	10.0000	1.0000	.1000	.0200	7/23/99	0745	ATM	62	76	45
✓	No	99.9998	10.0000	1.0000	.1000	.0200	7/24/99	1340	ATM	66	80	47
✓	YES P.O.	Would not calibrate					8/3/99	2117	ATM	70	84	49
✓	Yes	99.9998	10.0001	1.0002	.1000	.0201	8/4/99	1705	ATM	69	83	49
✓	NO	99.9998	10.0001	1.0001	.1000	.0200	8/5/99	2106	ATM	65	78	49
✓	Yes	99.9998	10.0000	1.0000	.1000	.0200	8/6/99	1536	ATM	68	81	50
✓	No	99.9999	10.0000	1.0001	.1000	.0200	8/7/99	1513	ATM	66	80	47
✓	Yes	99.9996	10.0001	1.0002	.1001	.0201	8/8/99	1700	ATM	64	78	46
✓	Yes	99.9997	10.0000	1.0001	.1000	.0200	8/9/99	1225	ATM	68	82	48
✓	Yes	99.9998	10.0001	1.0001	.1001	.0200	8/9/99	1615	ATM	69	84	46
✓	No	99.9997	10.0000	1.0000	.1000	.0200	8/10/99	1327	ATM	70	84	49
✓	Yes	99.9998	10.0000	1.0000	.1001	.0200	8/11/99	1043	ATM	67	81	48
✓	Yes	99.9996	10.0000	1.0001	.1001	.0201	8/11/99	2035	ATM	64	78	46
✓	Yes	99.9997	10.0000	1.0001	.1000	.0200	8/13/99	1230	ATM	66	80	47
✓	Yes	99.9998	10.0001	1.0002	.1002	.0201	8/14/99	1929	ATM	63	76	48
✓	Yes	99.9998	10.0000	1.0001	.1001	.0201	8/16/99	1135	ATM	64	77	48
✓	Yes	99.9998	10.0001	1.0001	.1001	.0201	8/17/99	1750	ATM	68	83	46
✓	Yes	99.9998	10.0000	1.0001	.1001	.0200	8/17/99	1650	ATM	70	84	47
✓	No	99.9999	10.0001	1.0000	.1000	.0201	8/27/99	2052	ATM	68	83	46
✓	NO	99.9999	10.0001	1.0002	.1001	.0202	8/30/99	1154	ATM	67	81	48
✓	No	99.9998	9.9999	1.0000	.1000	.0200	8/31/99	1310	ATM	63	76	48
✓	Yes	99.9997	10.0000	1.0000	.1000	.0200	8/31/99	1844	ATM	65	79	44
✓	Yes	99.9998	10.0000	1.0000	.1000	.0200	9/2/99	1032	ATM	60	74	43
✓	Yes	99.9998	10.0000	1.0002	.1002	.0200	9/8/99	1705	ATM	70	84	47
✓	YES	99.9996	10.0001	1.0002	.1001	.0201	9/11/99	1202	ATM	69	84	46
✓	Yes	99.9996	10.0000	1.0001	.1001	.0201	9/12/99	2058	ATM	70	84	49
✓	Yes	99.9996	10.0001	1.0002	.1000	.0201	9/13/99	1926	ATM	64	77	49
✓	Yes	99.9997	10.0001	1.0002	.1002	.0202	9/14/99	1335	ATM	81	73	63
✓	Yes	99.9996	10.0001	1.0002	.1002	.0201	9/14/99	2025	ATM	84	78	44
✓	Yes	99.9998	10.0001	1.0000	.1001	.0200	9/15/99	0820	ATM	82	66	42
✓	Yes	99.9996	10.0001	1.0001	.1001	.0201	9/16/99	0845	ATM	69	84	46
✓	No	99.9996	10.0000	1.0000	.1000	.0200	9/16/99	1655	ATM	70	84	49

Dates From 9/17/99

Through _____

WOODSTOVE DATA SHEET #4-4
SCALE QA SHEET

Scale Mettler
Model AE100
SN K04827

Level	Recali-brated	100g Weight	10g Weight	1.0g Weight	100mg Weight	20mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	Yes	99.9997	10.0000	1.0001	.1001	.0201	9/17/99	2045	ATM	66	79	47
✓	Yes	99.9997	10.0000	1.0000	.1001	.0200	9/18/99	1217	ATM	65	78	48
✓	No	99.9996	10.0000	1.0000	.1000	.0200	9/19/99	1245	ATM	62	75	47
✓	Yes	99.9998	10.0001	1.0001	.1001	.0201	9/23/99	2028	ATM	65	79	47
✓	Yes	99.9997	10.0000	1.0000	.1000	.0201	9/24/99	1145	ATM	64	77	49

Unit: Kuma Wood Classic
Run: EPA 2
Date: 9/13 1999
Technicians: ATM RLS
WST20, Form5

Woodstove Particulate Catch Processing Sheet
Woodstove Data Sheet #5
EPA M5G-1

Filters

Filter # (F) 932 | Beaker # 25 | Final Wt. 72.6563 g
Final Wt .8184 g | Ml 25 | Tare Wt. 72.6504 g
Tare Wt .7918 g | Desc. Acetone | Net Wt. .0059 g
Net Wt .0266 g

Filter # (E) 825 | Beaker # _____ | Final Wt. _____ g
Final Wt .7825 g | Ml _____ | Tare Wt. _____ g
Tare Wt .7811 g | Desc. _____ | Net Wt. _____ g
Net Wt .0014 g

Acetone Blank Calculation: Blank done 7/18/99

Blank Beaker # 1 | Final Wt 65.4847
Ml 50 | Tare Wt 65.4847
Desc Acetone | Net Wt .0000

.0000 g ÷ 50 ml = .0000 g/ml

Particulate Catch Calculation

Filter: .0266 g
Filter: .0014 g
Beakers: .0059 (Total Catch) − (25)(.0000) (Ml of Acetone Blank Value/Ml of Acetone) = .0059 g

Total Catch = .0339 g

Unit Kuma Wood Classic
Run # EPA 2
Date 9/13/1999
Technician ATM 12LS
WST6-Form1, Rev8/96

MISCELLANEOUS TEST DATA
WOODSTOVE DATA SHEET #8

Useable Firebox Dimensions: See QC Section Useable Volume: 2.228 ft³

Dilution Tunnel Draft (If applicable): Start 00.0 Stop 00.0

Test Chamber Air Velocity: Start: 00.0 Stop: 00.0 Avg: 00.0

Wet Bulb/ Start: WB: 62 °F DB: 74 °F 1.5 % Amb Moisture 50 %RH

Dry Bulb Stop: WB: 62 °F DB: 74 °F 1.5 % Amb Moisture 50 %RH

$\bar{X}$ = 1.5 % Ambient Moisture $\bar{X}$ = 50 % Relative Humidity (RH)

Empty Stove Wt: 419.3 lbs.

Empty Stove Wt with Stack (Inc. Oil Seal) Wet: 570.9 lbs. Dry: 509.2 lbs.

Empty Stove Wt with Stack and Ash Ash: — lbs. Total: — lbs.

Kindling Wt. Paper: 0.3 lbs. Wood: 4.2 lbs.

Pre Burn Fuel Wt. 14.1 + 14.3 + 14.3 Total: 42.7 lbs. ✓

Total Kindling and Pre Burn Fuel Wt 47.2 lbs. ✓

Coal Bed Wt-lbs: Range (572.8 - 572.2) 3.6 - 3.0 lbs. Actual: 3.6 lbs.

Allowable Amount of Charcoal that can be removed:

Coal Bed Wt. Range $\frac{3.6}{\text{Upper Wt.}} + \frac{3.0}{\text{Lower Wt.}}$ /2 X .25 = .8 ✓ lbs.

Test Fuel Wt-lbs: Ideal 15.6 lbs. Range: 17.1 - 14.1 lbs. Actual: 14.6 lbs.

Test Fuel Size (pcs.) (.75 x 1.5 x 5" Flanges) 16 Pcs.

2 x 4's x 15 15/16 " 3 Pcs 6.5 lbs. 44.5 % ✓

4 x 4's x 15 15/16 " 2 Pcs 8.1 lbs. 55.5 % ✓

Est. Dry Burn Rate (Kg/Hr.) $\frac{14.6 - (14.6 \times .17630)}{2.2046} \times \frac{60}{325} = 1.0070$ ✓ Est. Dry Burn Rate (Kg/Hr)

Est EPA Heat Output (HO_E) (Avg BTU's/Hr) (19,140) x $\frac{63}{100}$ x 1.007 = 12,143 ✓ Est Heat Output (HO_E) BTU's/Hr

Comments:

Stove Operating Data
Woodstove Test Data Sheet #9
Cold Start

Unit: KUMA WOOD CLASSIC
Run: EPA 2
Date: 9/13/99
Technician(s): ATH BLS.
Data Sheet #9 - Rev 1/98-Pg.2

Fire Started: 0805 P.D.S.T.

Warm up and Preburn: Primary Air: Wide open from ignition until the start of preburn when the primary air control(s) was (were) adjusted to the run setting of 7/16" OPEN. At the run setting until the start of the test.

Secondary Air:
No Controls, Naturally drafted

Secondary Burn/Cat Bypass: N/A

Charcoal Bed Preparation: Broke up, raked and leveled the coal bed prior to the addition of each warm up/pre burn fuel charge. Starting 1:30 before the start of the test, broke up, raked and leveled the coal bed. In stove for 34 seconds.

Test: Door wide open during loading _____ min 40 sec, then closed,

Primary Air: Wide open during the start of the test until 4:55.
Adjusted to the run setting of 7/16" between 4:55 and 5:00.
At the run setting of 7/16 open at 5:00 into the run.

Secondary Air:
No Controls. Naturally drafted.

Secondary Burn/Cat Bypass: N/A

Fan: ON/OFF during the warm up, ON/OFF High during the preburn, ON/OFF at the start of the test, ON/OFF for the first 30 minutes of the test, ON/OFF high at 30 minutes into the test, ON/OFF for the rest of the test.

Test Run Anomalies:
DBR was slower than expected,

Unit Kuma Wood Classic
Run # EPA 2
Date 4/13/1999
Technician ATM RLS
Page 1 of 4
WST7-Form2-A, Rev10/88

WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-1

Wood Data: Kindling: A mix of the below grades

	Size	Mill	Grade	Species
Pre Burn	2X4	Canyon Lumber	#2 & Better	D. Fir SFC Grn
Test Fuel	2X4	Canyon Lumber	#2 & Better	D. Fir SFC Grn
	4X4	R.I.B. Const.	#1	D. Fir SFC Grn

All grades WCLB Rules unless otherwise noted.

Warm up Information:

1st Warm up/Pre Burn Fuel charge (14.1 lbs) added at 0825.
2nd Warm up/Pre Burn Fuel charge (14.3 lbs) added at 0924.
3rd Warm up/Pre Burn Fuel charge (14.3 lbs) added at 1025.
4th Warm up/Pre Burn Fuel charge (_____ lbs) added at _____.
5th Warm up/Pre Burn Fuel charge (_____ lbs) added at _____.
6th Warm up/Pre Burn Fuel charge (_____ lbs) added at _____.
7th Warm up/Pre Burn Fuel charge (_____ lbs) added at _____.
8th Warm up/Pre Burn Fuel charge (_____ lbs) added at _____.

The coals were scooped out of the stove immediately prior to adding the 3rd pre burn/warm up fuel charge. The stove lost 1.7 lbs. 3.0 lbs. of coals were put back in the stove after the scoop.

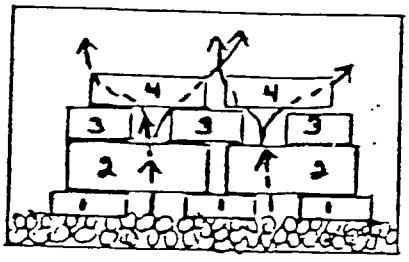
All pre burn/warm up fuel pieces were [redacted] 16" inches long. All preburn pieces/fuel charges were "ricked" in the stove. The pieces in the bottom layer in each rick contained 2 pcs that were 16 inches long and were loaded flat and perpendicular to the door. The pieces in the second layer in each rick were loaded on their side (edge) approximately parallel to the door and contained 4 pcs 16 inches long. The third layer (and fourth layer if present) was loaded flat, perpendicular to the door and contained 2 pcs 16 inches long. The majority of the pieces in each rick were in the second layer which had an approximate 0.5-1.0" space between pieces. (The loading directions indicate the direction of the longest dimension on each piece relative to the loading door opening.) Each pre burn/warm up fuel charge normally weighs within the weight range allowed for the actual test fuel charge

Unit Kuma Wood Classic
Run # EPA 2
Date 9/13/1999
Technician ATM RLS
Page 2 of 4
WST7-Form2-A, Rev 6/90

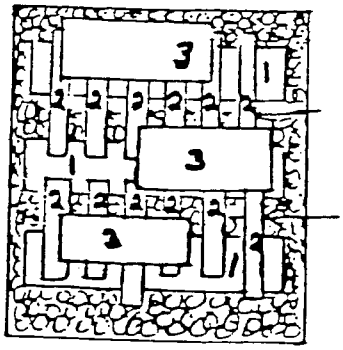
WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-2

Warm up Information (cont.):

Each warm up/preburn fuel charge was ricked in exactly (as much as possible) the same manner and the weight of each rick was usually within the allowable weight range for the test fuel charge. The physical arrangement and alignment of each rick was designed to accomplish three (3) things: (1)The bottom layer was nestled firmly into the coal bed and was as close to being level with the bottom of the stove as possible, thus providing a stable loading platform for the rest of the rick, keeping it in a ricked state (as opposed to a col- lapsed or fallen down state) untill the rick reached the charcoal stage and sags or collapses of its own accord. (2) It enhances the flow of primary air through the ricked preburn fuel charge, for the primary air would flow through the spaces between the pieces in the first layer and then up through the spaces between the pieces in the second, third and, if present, fourth layers. (3) It maximized, as much as possible, the surface to volume ratio of each preburn fuel charge, thereby allowing the fire immediate access to as much wood surface as possible and, thereby, insuring uniform charcoalization. All three of these enhance combustion and so get the stove as hot as possible during the warm up period, therby maximizing the amount of heat (BTU's) stored in the stove. The actual preburn was not started until the stove surface temperatures had maximized and stabilized, thus indicating that the amount of heat stored in the stove had peaked. For this stove, the thermal storage was monitored using the TOP surface temperature(s) and the peak value(s) obtained were 950 °F.



Front View



Top View

The arrows indicate the direction of the air flow through the rick.

The primary air was adjusted to the run setting of 7/16" OPEN 4.8 lbs above the upper charcoal bed weight.

Unit Lunar Nat Classic
Run # EPA 3
Date 9/13/99
Technician AMA
Page 3 of 4
WST5-Form2-Rev11/89

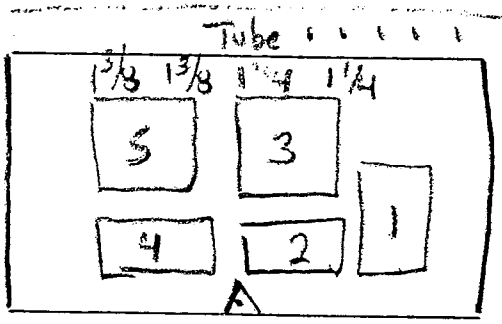
WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-3

Additional Comments: Test Start Sequence: ① Turned fan off. ② Opened primary air control wide open ③ opened door ④ loaded test fuel ⑤ cleared coals away from in front of the LPDO ⑥ Photograph ⑦ closed door.

TOTAL Elapsed Time: 0:40 Secs.

Test Fuel Charge Loading Information:

Test Fuel Charge and Loading Sequence Diagram



FRONT of stove view

4 X 4's: 1, 2 & 4

2 X 4's: 3 & 5

Loading Sequence: 1, 2, 3, 4 & then 5 last

Driest Pcs in Load 2 & 4, 3

Loaded the test fuel charge on an essentially level, medium / large sized, hot coal bed (in appearance, color and temperature for a medium low burn rate. Ignition 0:25 Load 0:40 1:15 VC to baffle, 1:45 VC Flames curling down on top of 4X4's, 1:36 Flames on Left side of L. Stack (flickers), 1:45 Flames in front of R. Canyon, 2:15, Secondaries / Flames above 3 & 5 coming forward past the front tube. 2:22 Front tube steadying to ignite,

* 3:23 Gas Balance

5:00 13.4% CO_2 / 1.20% CO

Flames ↓, Maintained a hot pocket with VC to baffle, plus Secondaries / flames on top of 3 & 5, Front tube flashing on & off plus flames on top L. Side of Pc 5, Maintained balance after shut down,

WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-4

Additional Comments:

6:45: Still in balance, but COT to 0.81%
7:30: 2nds/flames full width of 3 to 5.
8:05: right at Balance
8:14: In/Out of balance
8:30: In balance & CO ↓
9:04: In/Out again.
10:19 9.0/.85
11:00 CO_2 ↑ CO ↓
12:20 CO_2 ↓ CO ↑
15:19 Just in balance
15:45 Flames on the left side of L. Stack
17:30 All flames ↑ a little
18:25 Front tube flickering on/off.
18:50 Flames/2nds starting over
20:50 Taking off
23:45 11.8/.52 - hammer going down,
26:00 13.5/.24 - LPAO blowing a little. But above is burning OK.
30:00 Fan On high.

Unit: Kuma Wood Classic
Run: EPA 2
Date: 9/13/1999
Technician: ATM RLS

FUEL MOISTURE
WOODSTOVE TEST DATA SHEET #10

WST1-Form7-Rev11/89

Room Temperature: 69 °F Correction Factor: 0

NOTE: Record readings to the nearest 0.5% moisture
Uncor Values are corrected for temperature: Yes ✓. No ____
Time Test Fuel Moisture Readings taken at: 1035
Calibration Checks: X ____ Y ____ 12.5 12.0 22.0 22.5

Pc #	Dimen	Use	Top		Bottom		Side		Piece Avg
			Uncor	Cor	Uncor	Cor	Uncor	Cor	Corrected
1	2x4x8'	K	12.0	12.8	12.0	12.8	12.5	13.3	(12.767)
2									
3									
4	2x4x10'	P	18.5	19.8	18.5	19.8	18.0	19.2	19.600
5	2x4x8'	↓	21.5	23.1	21.0	22.6	20.5	22.0	22.567
6	"	↓	21.5	23.1	21.5	23.1	20.5	22.0	22.733
7	"	↓	18.0	19.2	18.0	19.2	18.0	19.2	19.200
8									(84.100)
9									
10	2X4-15 15/16"	T	18.0	19.2	18.0	19.2	18.6	19.2	19.200
11	"	↓	19.5	20.9	19.0	20.3	18.5	19.8	20.333
12	"	↓	22.5	24.3	22.0	23.7	22.5	24.3	24.100
13									
14	4X4-15 9/16"	T	19.0	20.3	19.0	20.3	19.0	20.3	20.300
15	"	↓	21.5	23.1	21.5	23.1	21.5	23.1	23.100
16									(107.033)
17									
18									
19	5X1.5X.75	Spacers	20.5	22.0	20.0	21.4	20.5	22.0	21.800
20									OUT-SPACERS

	Kindling	Pretest Fuel	Test Load
% Moisture - Dry Basis:	12.967 %	21.025 %	21.407 %
% Moisture - Wet Basis:	11.478 %	17.372 %	17.632 %

To obtain Wet from Dry: $\frac{100 \times \%\ \text{Dry Rdg.}}{100 + \%\ \text{Dry Rdg.}}$ = % Moisture, Wet Basis

Acceptable Ranges: 16-20% wet; 19-25% dry
(17.5 - 22.5 on Meter [Uncor reading] at 70°F)

Key for Use: K= Kindling P= Pretest Fuel T= Test Fuel

Unit: Kuma Wood Classic
Run#: EPA 2
Date: 9/13/1999
Technician: ATM RLS

WOOD DENSITY DETERMINATION
WOODSTOVE TEST DATA SHEET #11

WST2-form11-Rev 6/90

Wood Piece: Nominal Dimensions: 3½" X 3½" X 1½" IN

Depth (D): IN 1.533 cm 3.894

Width (W): IN 3.531 cm 8.969

Length (L): 3.439 IN
3.445 IN
3.432 IN
3.463 IN

Length $\bar{X}$ = IN 3.445 cm 8.750

Volume: 305.596 cm^3
(D X W X L)

MOISTURE: Room Temperature: 69 °F Correction Factor: 0

Uncorrected Meter Readings Corrected for temperature: Yes ✓ No ___

NOTE: Record moisture meter readings to the nearest 0.5%

	Uncor	Cor
Top:	18.0	19.2 %
Bottom:	18.0	19.2 %
Side:	18.0	19.2 %
$\bar{X}$:		19.200 %

Avg % Moisture (Dry) 19.200 %

Aug % Moisture (Wet) 16.107 %

Scale: Leveled In ✓ Out ___
Zeroed: In ✓ Out ___

Wet Weight: 157.8 g Dry Weight: 134.0 g

% Moisture Dried Basis: 15.092 %
[1 - (Dry Wt ÷ Wet Wt)] X 100

	Date	Time	Temp
Into Dryer	9/13/11	1040	213 °F
Out of Dryer	9/22/99	1548	214 °F

(Minimum Time in Dryer: 24 hrs.) Minimum Dryer Temp 100°C (212°F)

Density = 134.0 g (dry wt) ÷ 305.596 cm^3 (volume) = 0.4385 g/cm^3

Pellet Fuel Moisture Content Determination

Tare Beaker Wt. ___ g

Wet Wt: ___ g - ___ g = ___ g
Gross Wet Wt. Tare Beaker Wt. Net Wet Wt.

Dry Wt: ___ g - ___ g = ___ g
Gross Dry Wt. Tare Beaker Wt. Net Dry Wt.

% Moisture Dried Basis: ___ %
[1 - (Net Dry Wt ÷ Net Wet Wt.)] X 100

BURN RATE AND FLUE GAS DATA
WQ[illegible]TOVE DATA SHEET #12
WS[illegible]Form 14 Rev 1/88

Unit: Kuma Wood Classic Date: 9/13/10
Run: EPA 2 Technician(s): AJ RLC
Page: 1 of 3

END Wt: 512.8 lbs.

Minute Time	Scale Wt	lbs left	Burn Rate	CO2 v.	CO2 %CO2	O2 v.	O2 %O2	Tel	CO v.	CO %CO	T/C(1) Bal	T/C(2) Wet Bulb	T/C(2) Dry Bulb	% H2O	Calc W/B	T/C(3) Stack	SO2 v.	SO2 PPM	Static Press.	Comments
0																				
1005	527.4	14.6		.298	7.39	49.4	12.34		19.8	1.00	7.4	86	97			248			-.035	Flow
5 30	526.4	13.6	1.0	.475	11.75	26.7	6.67		4.2	0.32	53.4	88	109			-08			-.074	SO2 1.5
10 35	525.8	13.0	.6	.361	8.94	45.3	11.32	GAS BAL.	16.9	0.86	10.4	92	115			371			-.058	CO2 1.5
15 40	525.2	12.4	.6	.363	8.99	44.4	11.09		16.8	0.81	11.1	96	117			356			-.057	O2 1.5
20 45	524.6	11.8	.6	.409	10.13	39.7	9.92		13.1	0.67	15.1	100	120			365			-.058	CO 1.5
25 50	524.0	11.2	.6	.445	11.02	35.7	8.92		13.4	0.67	16.4	103	122			384			-.060	
30 55	523.2	10.4	.8	.549	13.58	28.2	7.05		4.7	0.25	54.3	106	123			414			-.062	
35 1300	522.4	9.8	.6	.568	14.05	26.6	6.65		4.1	0.22	63.9	107	124			422			-.063	
40 05	521.9	9.1	.7	.557	13.78	27.8	6.95		3.8	0.21	65.6	108	123			421			-.062	
45 10	521.3	8.5	.6	.554	13.70	27.7	6.92		4.4	0.23	59.6	107	122			412			-.062	
50 15	520.7	7.9	.6	.565	13.97	26.9	6.72		5.6	0.29	48.2	107	121			413			-.061	
55 20	520.0	7.2	.7	.577	14.27	25.7	6.42		3.8	0.21	67.9	107	121			415			-.061	
																4734			.713	Flow
60 25	519.3	6.5	.7	.582	14.39	25.0	6.25		3.1	0.17	84.7	107	120			415			-.061	SO2 1.5
65 30	518.7	5.9	.6	.597	14.76	23.2	5.80		4.1	0.21	70.3	107	120			419			-.061	CO2 1.5
70 35	518.2	5.4	.5	.555	13.73	28.0	7.00		2.3	0.12	114.4	107	118			405			-.060	O2 1.5
75 40	517.7	4.9	.5	.521	12.89	31.1	7.77		2.4	0.13	99.1	107	116			391			-.058	CO 1.5
80 45	517.2	4.4	.5	.514	12.72	31.1	7.77		2.7	0.15	84.8	106	114			383			-.057	
85 [illegible]	516.8	4.0	.4	.515	12.74	30.4	7.60		1.7	0.10	127.4	105	112			384			-.056	
90 55	516.4	3.6	.4	.479	11.85	33.8	8.45		3.1	0.16	74.1	104	110			368			-.055	
95 1400	516.2	3.4	.2	.388	9.61	43.0	10.74		9.9	0.51	18.8	103	108			344			-.051	
100 05	516.0	3.2	.2	.322	7.98	47.9	11.97	OUT BAL.	16.8	0.85	9.4	102	105			320			-.047	
105 10	515.8	3.0	.2	.271	6.73	51.7	12.92		22.2	1.13	6.0	101	101			296			-.044	
110 15	515.7	2.9	.1	.267	6.63	51.9	12.97		24.0	1.20	5.5	100	99			283			-.042	
115 20	515.5	2.7	.2	.267	6.63	51.7	12.92		23.7	1.19	5.6	99	99			275			-.040	
																4083			1.332	

9017 1.345

BURN RATE AND FLUE GAS DATA
WOOD STOVE DATA SHEET #12
WST2-Form 14 Rev 1/88
END WT.: 512.8 lbs,

Unit: KUMA WOOD CLASSIC Date: 9/13/99
Run: EPA 2 Technician(s): ATH, RLS,
Page: 2 of 3

Minute / Time	Scale Wt	lbs left	Burn Rate	1 CO2 v.	1 CO2 %CO2	2 O2 v.	2 O2 %O2	Tel	3 CO v.	3 CO %CO	Bal	T/C(1) Wet Bulb	T/C(2) Dry Bulb	% H2O	Calc W/B	T/C(3) Stack	4 SO2 v.	SO2 PPM	Static Press.	Comments
120 1425	515.4	2.6	.1	.244	6.06	53.4	13.34		28.0	1.40	4.3	94	95			258			-.037	Flow
125 30	515.4	2.6	0	.239	5.94	53.6	13.39		28.9	1.45	4.1					250			-.036	SO2 1.5
130 35	515.3	2.5	.1	.237	5.89	53.9	13.46		28.8	1.44	4.1					243			-.035	CO2 1.5
135 40	515.2	2.4	.1	.233	5.79	54.2	13.54		30.0	1.50	3.9					239			-.035	O2 1.5
140 45	515.1	2.3	.1	.233	5.79	54.1	13.51		31.1	1.56	3.7					233			-.034	CO 1.5
145 50	515.0	2.2	.1	.229	5.69	54.2	13.54		32.2	1.62	3.5					230			-.033	
150 55	515.0	2.2	0	.212	5.27	56.3	14.06		34.8	1.74	3.0					228			-.032	
155 1500	514.9	2.1	.1	.203	5.05	56.7	14.16		33.9	1.69	3.0					231			-.032	
160 05	514.8	2.0	.1	.204	5.07	56.9	14.21		32.9	1.65	3.1					228			-.031	
165 10	514.8	2.0	0	.212	5.27	56.2	14.04		30.2	1.52	3.5					225			-.030	
170 15	514.7	1.9	.1	.220	5.47	55.7	13.91		29.1	1.47	3.7					215			-.030	
175 20	514.7	1.9	0	.226	5.62	55.4	13.84		28.2	1.42	4.0					214			-.029	
																(279)			(.394)	Flow
180 25	514.6	1.8	.1	.220	5.47	56.0	13.99		29.1	1.47	3.7					210			-.028	SO2 1.5
185 30	514.5	1.7	.1	.225	5.59	55.3	13.81		28.1	1.43	3.9					212			-.028	CO2 1.5
190 35	514.5	1.7	0	.228	5.67	55.3	13.81		27.7	1.39	4.1	85	95			212			-.028	O2 1.5
195 40	514.4	1.6	.1	.229	5.69	55.1	13.76		26.9	1.35	4.2	85	101			210			-.028	CO 1.5
200 45	514.3	1.5	.1	.236	5.86	54.5	13.61		26.0	1.32	4.4	87	108			209			-.027	
205 50	514.3	1.5	0	.239	5.94	54.3	13.56		25.4	1.29	4.6	87	112			209			-.027	
210 55	514.2	1.4	.1	.239	5.94	54.4	13.59		26.3	1.31	4.5	88	114			208			-.027	
215 1605	514.1	1.3	.1	.235	5.84	54.9	13.71		25.7	1.29	4.5	88	116			207			-.027	
220 05	514.1	1.3	0	.234	5.81	55.3	13.81		27.0	1.33	4.4	88	116			207			-.027	
225 10	514.0	1.2	.1	.231	5.74	55.1	13.76		30.4	1.52	3.8	89	117			207			-.026	
230 15	513.9	1.1	.1	.230	5.71	55.0	13.74		31.0	1.56	3.7	89	117			207			-.026	
235 20	513.8	1.0	.1	.226	5.62	55.3	13.81		31.5	1.59	3.5	89	118	3.6	103	206			-.026	
																(250)			(.325)	
																5298			.719	

BURN RATE AND FLUE GAS DATA
WOOD ...YE DATA SHEET #12
WST2-... Rm 14 Rev 1/88
END WT. 512.8 lbs

Unit: KUHA WOOD CLASSIC Date: 9/13/94
Run: EPA 2 Technician(s): A.T.N, D, RLS.
Page: 3 of 3

Minute / Time	Scale Wt	lbs left	Burn Rate	1 CO_2 v.	1 CO_2 %CO_2	2 O_2 v.	2 O_2 %O_2	Tel	3 CO v.	3 CO %CO	T/C(1) Bal	T/C(2) Wet Bulb	T/C(2) Dry Bulb	% H_2O	T/C(3) Calc W/B	T/C(3) Stack	4 SO_2 v.	4 SO_2 PPM	Static Press.	Comments
240	513.8	1.0	0	.205	5.10	57.1	14.21e		32.8	1.64	3.1	89	118	3.6	102	204			-.021e	Flow
245 30	513.7	.9	.1	.204	5.07	57.0	14.24		32.4	1.62	3.1	89	119	3.6	102	203			-.022	SO_2 1.5
250 35	513.7	.9	0	.202	5.02	57.3	14.31		33.4	1.70	3.0	89	118	3.6	101	202			-.021e	CO_2 1.5
255 40	513.6	.8	.1	.199	4.95	57.6	14.39		34.1	1.73	2.9	89	118	3.6	101	200			-.021e	O_2 1.5
260 45	513.5	.7	.1	.191	4.75	58.4	14.59		34.3	1.73	2.7	89	118	3.6	101	199			-.025	CO 1.5
265 50	513.5	.7	0	.184	4.58	59.4	14.89		31.7	1.58	2.9	89	117	3.7	101	196			-.025	
270 55	513.4	.6	.1	.177	4.41	59.7	14.91		32.8	1.64	2.7	88	117	3.5	101	194			-.025	
275 1700	513.3	.5	.1	.179	4.46e	60.1	15.01		30.6e	1.55	2.9	88	116e	3.6	101	192			-.025	
280 05	513.3	.5	0	.173	4.31	60.6	15.14		32.2	1.62	2.7	88	116e	3.6	101	192			-.024	
285 10	513.2	.4	.1	.185	4.61	59.9	14.96		30.7	1.55	3.0	88	116e	3.6	101	191			-.024	
290 15	513.2	.4	0	.180	4.48	60.2	15.04		31.6e	1.58	2.8	88	116e	3.6	101	189			-.024	
295 20	513.1	.3	.1	.178	4.43	60.5	15.11		31.2	1.56e	2.8	88	116e	3.6	101	188			-.024	
																(2350)			(.300)	Flow
300 25	513.1	.3	0	.176e	4.38	60.5	15.11		32.5	1.63	2.7	87	115	3.3	101	187			-.024	SO_2 1.5
305 30	513.0	.2	.1	.184	4.58	59.6	14.89		31.9	1.59	2.9	87	115	3.3	100	186			-.024	CO_2 1.5
310 35	513.0	.2	0	.174	4.33	60.9	15.21		32.7	1.65	2.6e	87	114	3.3	100	185			-.024	O_2 1.5
315 40	512.9	.1	.1	.167	4.16e	61.2	15.29		32.3	1.63	2.6e	87	113	3.4	100	185			-.023	CO 1.5
320 45	512.9	.1	0	.153	3.82	62.7	16.66e		33.4	1.68	2.3	86	112	3.3	100	183			-.023	
325 50	512.8	0	.1	.141	3.52	63.9	15.96e		33.9	1.71	2.1	86e	111	3.3	100	182			-.023	
330 55																(1108)			(.141)	
335																				
340														16e+		(14,773)			(2.505)	
345																17,783				
350																(224)			(.038)	
355																269				

Pre Burn Start wt. 4.8 lbs.
Test Start wt. Range 572.8 - 512.2 lbs.

PRE BURN DATA
RECORD SHEET #13
WST2-Form16

BARO. PRESSURE 28.77 "Hg

Unit: Kuma Wood Classic
Run: EPA 2
Page: 1 of 1

Date: 9/13/19
Technician(s): ATM RHS

T/C#-3

Minute Time	Scale Weight	Burn Rate	Stack	4 Stove Top	5 Left Side	6 Back	7 Right Side	8 Bottom	9 Firebox	10 2nd Burn ~~Catalytic~~	11 Room Temp	Static
0	572.6	0	631	940	609	455	608	533	1093	1724	71	-.087
5	566	1.0	525	886	637	444	624	535	978	1661	72	-.077
10	565.7	.9	500	864	645	438	627	536	981	1573	72	-.073
15	565.0	.7	465	830	653	435	628	530	1016	1591	74	-.070
20	564.4	.6	421	759	656	434	629	521	1129	1358	74	-.069
25	564.1	.3	369	639	658	434	621	513	1081	1165	73	-.057
30	564.0	.1	348	536	650	431	609	509	1017	1196	73	-.054
35	563.8	.2	329	514	635	415	590	504	963	1137	73	-.051
40	563.7	.1	313	483	619	401	573	497	934	1079	73	-.047
45	563.6	.1	303	454	601	388	555	487	892	979	72	-.041
50	563.5	.1	291	434	586	379	542	480	870	952	72	-.043
55	563.5	0	281	416	569	369	529	473	853	933	72	-.042
60	563.4	.1	275	401	552	359	516	466	842	919	72	-.041
65	563.3	.1	268	392	540	352	505	462	834	916	71	-.040
70	563.2	.1	263	383	529	345	495	458	831	910	72	-.039
75	563.1	.1	259	375	520	338	488	454	823	899	72	-.038
80	563.1	0	255	369	513	332	481	451	819	899	71	-.037
85	563.0	.1	253	364	507	328	474	448	818	903	72	-.036
90	562.9	.1	250	361	502	323	468	446	814	913	72	-.036
95	562.8	.1	248	358	497	318	462	443	817	914	72	-.035
100	30											

Hot Box On

Comments
13/16 Orifice
Primary Air Set at 7/16" OPEN
Secondary Air Set at N/A
Fan: ON HIGH
TUNNEL ON AT: 1054
Buckets IN LD
ANALYZERS SPANNED
Pumps turned on at: 11:25
RATE 2015

	531.6 ΔT
	514.6
Check WB/DB: 84/90	417.0
	484.2
Probe IN TUNNEL	
	458.8
	450.2
	442.0
	435.0
	429.2
	424.2
	415.6

TEMPERATURES
RECORD SHEET #14
WST2-Form14 Rev7/96

Unit: Kuma Wood Classic Date: 9/13/1[illegible]
Run: EPA 2 Technician(s):
Page: 1 of 3

AFM DLS

T/C#	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Minute / Time	Stove Top	Left Side	Back	Right Side	Bottom	Firebox	2nd Burn [redacted]	Room Temp	Tunnel	C. Gas Box	Impinger Out	5G-1 Filter	5G-1 Condenser	Rear 2nd [redacted]	HOT BOX
0 / 1[illegible]5	358	497	318	462	443	817	914	72	99	250	36	87	51	797	248
5 / 30	317	485	325	454	442	703	1120	72	120	250	36	88	37	1088	248
10 / 35	513	477	314	445	441	698	1368	72	114	250	37	88	37	810	248
15 / 40	514	468	309	436	438	704	1331	73	111	250	37	88	38	1001	249
20 / 45	525	464	305	430	434	730	1360	72	110	250	37	88	38	939	250
25 / 50	547	467	302	428	429	766	1366	73	111	250	38	88	37	1024	250
30 / 55	597	465	301	439	424	788	1432	73	114	250	38	88	37	1143	250
35 / 1300	635	484	280	443	419	814	1393	73	114	250	38	88	38	1088	250
40 / 05	641	500	267	453	415	848	1396	73	114	250	38	88	38	1072	250
45 / 10	639	514	257	462	410	880	1395	73	114	250	38	88	37	1102	249
50 / 15	639	528	253	473	406	922	1444	74	114	250	38	88	37	1123	249
55 / 20	644	534	253	486	403	978	1394	74	116	250	39	88	37	1111	249
	6619	5883	3484	5401	6104	9648	15,913	874							
60 / 25	648	549	257	499	401	1020	1420	74	116	250	39	88	38	1096	248
65 / 30	656	558	260	509	399	1106	1463	74	116	250	39	88	38	1128	248
70 / 35	646	567	264	520	399	1092	1332	74	116	250	39	88	38	1218	249
75 / 40	624	574	270	527	398	1087	1303	74	115	250	39	88	38	1166	250
80 / 45	608	579	275	530	397	1008	1247	75	114	250	39	88	37	1127	250
85 / 50	609	582	281	532	395	1004	1200	75	114	250	39	88	38	1214	250
90 / 55	598	583	286	536	395	990	1191	75	113	250	39	88	38	1131	250
95 / 1400	559	581	289	539	396	967	1181	75	112	250	39	88	38	1048	250
100 / 05	570	578	290	535	397	937	1095	76	110	249	39	88	38	1044	250
105 / 10	470	570	289	524	397	886	1032	76	109	249	39	88	38	1064	250
110 / 15	441	558	285	513	396	861	1006	76	108	249	39	88	38	1020	250
116 / 20	424	545	282	504	395	844	975	76	107	249	39	88	38	1047	249
	6193	6824	3328	6268	4765	11,802	14,445	900							
	13,712	12,707	6812	11,669	9869	21,450	30,358	1774							

TEMPERATURES
RECORD SHEET #14
WST2-Form14 Rev7/96

Unit: KUMA WOOD CLASSIC Date: 9/13/99
Run: EPA 2 Technician(s): ATH, RLS
Page: 2 of 3

T/C# / Minute / Time	4 Stove Top	5 Left Side	6 Back	7 Right Side	8 Bottom	9 Firebox	10 2nd Burn ~~Catalytic~~	11 Room Temp	12 Tunnel	13 C. Gas Box	14 Impinger Out	15 5G-1 Filter	16 5G-1 Condenser	17 ~~Con-dar~~ Probe 1 use	18 HOT BOX
120 1425	406	531	277	497	394	831	936	76	106	249	39	88	38	1021	249
125 30	392	520	273	491	393	816	918	76	106	249	40	88	38	1028	249
130 35	381	508	268	483	391	799	897	76	105	250	40	88	38	1027	250
135 40	371	498	265	478	390	783	877	76	105	250	40	88	38	994	250
140 45	362	487	264	472	388	770	862	76	104	250	40	88	38	957	250
145 50	356	477	263	468	386	761	851	76	104	250	37	88	38	929	250
150 55	350	468	262	464	385	750	837	76	103	250	36	88	38	877	250
155 1500	342	459	259	457	383	740	823	76	103	250	36	88	38	870	250
160 05	335	450	256	449	381	732	810	76	102	250	37	88	38	869	250
165 10	329	443	253	442	381	722	799	76	102	250	37	88	38	872	249
170 15	326	436	252	436	381	717	794	76	102	250	37	88	38	870	249
175 20	323	431	252	431	382	715	789	76	101	249	37	88	38	877	249
	4273	5708	3144	5568	4635	9136	10,193	912							
180 25	319	425	252	427	382	713	773	76	101	249	37	88	38	901	249
185 30	316	421	251	423	382	712	765	77	101	249	37	88	38	907	249
190 35	312	417	252	419	382	714	758	77	101	248	37	88	38	937	249
195 40	311	413	252	416	381	712	755	76	100	249	37	88	38	952	249
200 45	309	411	253	414	381	715	753	76	100	249	37	88	38	969	248
205 50	308	409	254	411	380	721	749	77	100	249	37	88	38	974	249
210 55	306	407	256	409	379	722	744	76	100	250	37	88	38	966	250
215 1600	304	406	257	407	378	720	742	76	100	250	37	88	38	955	250
220 05	302	405	258	405	378	738	792	77	100	250	37	88	38	840	250
225 10	302	405	256	402	377	747	791	77	99	250	37	88	38	830	250
230 15	301	405	254	399	378	744	768	76	100	250	37	88	38	832	250
235 20	299	405	251	395	379	752	758	77	100	251	38	88	38	806	250
	3199	4927	3048	4927	4557	8710	9148	918							
	7962	10,637	6190	10,495	9192	17,846	19,341	1830							

TEMPERATURES
RECORD SHEET #14
WST2-Form14 Rev7/96

Test: KUHA WOOD CLASSIC Date: 9/13/99
Run: EPA 2 Technician(s): ATM, DLS.
Page: 3 of 3

T/C#	4	5	6	7	8	9	10	11	12	13	14	15	16	17 REAR 2nd	18
Minute / Time	Stove Top	Left Side	Back	Right Side	Bottom	Firebox	2nd Burn ~~Catalytic~~	Room Temp	Tunnel	C. Gas Box	Impinger Out	5G-1 Filter	5G-1 Condenser	~~Con~~ dar	Hot Box
240 1625	297	405	249	391	381	747	742	77	99	250	38	89	38	808	250
245 30	295	405	246	386	381	742	737	77	99	250	38	89	38	808	250
250 35	293	405	244	381	381	738	730	77	99	249	38	89	38	798	249
255 40	291	404	242	376	380	735	721	77	99	249	38	89	38	788	249
260 45	288	402	241	371	380	729	714	77	99	249	38	89	38	790	249
265 50	286	400	239	367	378	715	703	78	98	248	38	89	38	768	248
270 55	283	397	237	362	377	688	689	77	98	249	38	89	38	772	248
275 1700	279	394	235	357	375	687	682	77	98	249	38	89	38	799	248
280 05	276	390	233	352	372	665	672	77	98	249	38	89	38	769	248
285 10	274	386	233	348	372	654	671	77	97	250	38	89	38	761	248
290 15	272	383	231	345	370	653	667	77	97	250	38	89	38	761	248
295 20	271	379	230	342	370	645	662	77	97	250	38	89	38	750	248
	3405	4740	2860	4378	4517	8398	8390	925							
300 25	269	376	229	340	369	633	658	77	96	250	38	89	38	746	248
305 30	268	373	228	338	368	621	654	76	96	249	38	89	38	734	248
310 35	265	370	227	335	367	614	650	76	96	249	38	89	38	706	248
315 40	263	367	225	334	366	614	644	76	95	249	38	89	38	710	249
320 45	261	363	222	332	366	595	632	76	95	248	38	89	38	685	248
325 50	259	359	221	329	365	588	621	76	94	248	39	90	39	669	247
330 55	1685	2208	1352	2008	2201	3665	3859	457							
335															
340	26,364	28,302	17,214	28,550	25,771	67,359	61,948	4986	66 ÷	AVG. STOVE TEMP		CHANGE	START:	416.6	✓
345		30,302											STOP:	306.6	✓
350	399	459	261	433	391	778	939	76					ΔT:	109.0	✓
355		459													

WST6-Form8 Rev 5/96

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-1

Site: Myren Consulting, Woodinville, WA Date: 9/13/99 Analyte: CO_2

Source: Kuma Wood Classic Run #: EPA 2

Zero Cyl #: 719 430 Conc. 00.0 % CO_2 Cyl Press: 1850 psi

Certified by: Oxarc Date: 4/1/99

Span Cyl #: 250-794 Conc. 12.5 % CO_2 Cyl Press: 1320 psi

Certified by: Oxarc Date: 3/26/99

Analyzer: Make: Horiba Model: PIR-2000 SN: 607024

Range: 0 - 25.0% CO_2 Analyzer Output: 0 - 1.0 v.

Flow: 1.5 SCFH Measured by: Rotameter: X Flowmeter:

EPA Span Value = 25.0% CO_2

EPA Control Limits = ± 2.5% of 25.0% CO_2 = ± 0.625% CO_2

Pre Run Audit: By: RLS Time: 1110 Temp: 74 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	.000	00.0	00.0	.000	.0446	.0446	+0.18
Span	50.0	.500	12.5	49.8	.498	12.3218	-.1782	-1.43

Comments:

Post Run Audit: By: RLS Time: 1830 Temp: 76 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	.000	00.0	00.0	.000	.0446	.0446	+0.18
Span	50.0	.500	12.5	49.6	.495	12.2479	-.2521	-2.02

Comments:

± Conc. Difference = Act % - Exp (Std) %

Zero % Differece = $\frac{\text{Act \% (ppm)} - \text{Exp \% (ppm)}}{\text{Full Scale Value}} \times 100$

Span % Difference = $\frac{\text{Act \% (ppm)} - \text{Exp \% (ppm)}}{\text{Exp \% (ppm)}} \times 100$

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-2

Site: Myren Consulting, Woodinville, WA Date: 9/13/99 Analyte: O_2

Source: Kuma Wood Classic Run #: EPA 2

Zero Cyl #: 719 430 Conc. 00.0 % O_2 Cyl Press: 1850 psi

Certified by: Oxarc Date: 4/1/99

Span Cyl #: 250-794 Conc. 12.5 % O_2 Cyl Press: 1320 psi

Certified by: Oxarc Date: 3/26/99

Analyzer: Make: Taylor Model: OA 137 SN: 137/4772

Range: 0 - 25.0% O_2 Analyzer Output: 0 - 100 mv.

Flow: 1.5 SCFH Measured by: Rotameter: X Flowmeter:

EPA Span Value = 25.0% O_2
EPA Control Limits = + 2.5% of 25.0% O_2 = + 0.625% O_2

Pre Run Audit: By: RLS Time: 1110 Temp: 74 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	00.0	00.0	.0050	+0.0050	+0.02
Span	12.5	50.0	12.5	12.5	49.9	12.465	-.03421	+0.27

Comments:

Post Run Audit: By: RLS Time: 1880 Temp.: 76 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	00.0	00.0	.0050	+0.0050	+0.02
Span	12.5	50.0	12.5	12.5	49.7	12.4158	-0.0842	-0.67

Comments:

± Conc. Difference = Act % - Exp (Std) %

Zero % Differece = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}} \times 100$

Span % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Exp \% (ppm)}} \times 100$

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-3

Site: Myren Consulting, Woodinville, WA Date: 1/13/99 Analyte: CO

Source: Kuma Wood Classic Run #: EPA 2

Zero Cyl #: 719 430 Conc. 00.0 % CO Cyl Press: 1850 psi

Certified by: Oxarc Date: 4/1/99

Span Cyl #: 250-794 Conc. 2.5 % CO Cyl Press: 1320 psi

Certified by: Oxarc Date: 3/26/99

Analyzer: Make: Infra Red Model: 702 D SN: 113

Range: 0 - 10.0% CO Analyzer Output: 0 - 100 mv.

Flow: 1.5 SCFH Measured by: Rotameter: X Flowmeter:

EPA Span Value = 5.0% CO

EPA Control Limits = +2.5% of 5.0% CO = + 0.125% CO

Pre Run Audit: By: RLS Time: 1110 Temp: 74 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	0.00	00.0	.0093	.0093	-0.19
Span	2.50	50.0	2.50	2.50	49.9	2.4864	-0.0136	-0.54

Comments:

Post Run Audit: By: RLS Time: 1830 Temp.: 76 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	0.00	00.0	.0093	.0093	-0.19
Span	2.50	50.0	2.50	2.49	49.7	2.4764	-.0236	-0.94

Comments:

± Conc. Difference = Act % - Exp (Std) %

Zero % Differece = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}} \times 100$

Span % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Exp \% (ppm)}} \times 100$

Unit: Kuma Wood Classic
Run: EPA 2
Date: 9/13/199
Technicians: ATM / RLS
WST6-Form3-Rev11/89

QUALITY CHECKS
WOODSTOVE DATA SHEET #16

Ambient = Tr: _____ °F T/C#30: _____ °F

Thermocouple Check (at ambient): T/C#1: 64 °F; T/C#2: 64 °F;

T/C #3: 65 °F; T/C #4: 65 °F; T/C #5: 65 °F;

T/C #6: 66 °F; T/C #7: 66 °F; T/C #8: 66 °F;

T/C #9: 66 °F; T/C #10: 67 °F; T/C #11: 66 °F;

T/C #12: 66 °F; T/C #13: 65 °F; T/C #14: 65 °F;

T/C #15: 66 °F; T/C #16: 65 °F; T/C #17: 66 °F;

T/C #18: 65 °F; T/C #19: _____ °F; T/C #20: _____ °F;

T/C #21: _____ °F; T/C #22: _____ °F; T/C #23: _____ °F;

T/C #24: _____ °F; T/C #25: _____ °F; T/C #26: _____ °F;

Comments: _____

Thermocouple Readout: Pretest Zero/Span Check and Calibration:

Zero (0°F): 001 °F Adj to: 000 °F Post Test Check Zero (0°F): 001 °F % Difference +0.05%

Span (2000°F): 1999 °F Adj to: 2000 °F Span (2000°F): 2000 °F 0

(Allowable % Difference = 1.5%. Use formulas on Woodstove Data Sheet #15 to calculate % Difference)

Thermocouple Readout Pretest Linearity Check

0°F = 000 °F; 200°F = 201 °F; 400°F = 399 °F;

600°F = 599 °F; 800°F = 800 °F; 1000°F = 1000 °F;

1200°F= 1200 °F; 1400°F = 1400 °F; 1600°F = 1599 °F

1800°F= 1800 °F; 2000°F = 2000 °F

Combustion Gas (CO_2,O_2,CO) Train Leak Check: Pre ✓ Post ✓

Draft (Static) Guage Zero Check: Pre ✓ Post ✓

Scale Check Pre (Wt, #'s): 570.9-575.9 5.0 lbs. ok (RLS)

Post (Wt, #'s): 572.8-577.8 5.0 lbs. ok (RLS)

Stack cleaned prior to the run: Yes ____ No ✓

Tunnel cleaned prior to the run: Yes ____ No ✓

KumaEPA4

DILUTION TUNNEL CALCULATIONS — MYREN CONSULTING CERTIFICATION TEST DATA

3/31/96

File Name:	KumaEPA4
Stove Manufacturer:	Kuma
Model Number:	Wood Classic
Lab Name:	MYREN
Test Date:	9\15\99
Run Number:	EPA 4
Meter Box Y Factor:	1.0151
Barometric pressure (in):	28.498
Gas meter temp (ave):	92
delta H(avg):	0.900
Gas meter initial reading:	878.200
Gas meter final reading:	987.420
Front catch (acetone) mg:	7.4
first filter catch (mg):	14
second filter catch (mg):	-0.3
tunnel flow (ave cfm):	147.109
Emission Rate(g/hr):	1.869
Emission Rate(M5H) :	3.059
vs/VmTs:	0.0154
vs ave:	877.296
Tunnel average temp (°f):	104.952
Test time(min):	195
Fuel Load(lb. wet):	14.6
Wood moisture(%wet):	17.660
Burn rate(dry kg/hr):	1.678
Samp vol(scf):	101.108
front filter number	936
back filter number	935
acetone beaker number	28
PRELIMINARY RESULTS	
FINAL RESULTS	AUDITED

DATA SUMMARY

MODEL :	Wood Classic
RUN:	EPA 4
DATE:	9\15\99
DBR:	1.678
GPH UNADJ	1.869
ADJ	3.058516319

RUN TIME (min)	PITOT DELTAP (- INCH H20)	TNL TEMP (°F)	GAS METER RDG (ft3)	GAS METER TEMP (°F)	GAS METER DELTA H (in.H2O)	TUNNEL VELOCIT (ft/min)	PROP RATE (%)	dDGM vol std (ft3)
0	0.043	94	878.200	83	0.900	868.77		
10	0.043	109	883.805	83	0.900	880.45	103.6	5.280
20	0.043	112	889.375	85	0.900	882.77	101.7	5.227
30	0.043	116	894.950	87	0.900	885.85	101.9	5.213
40	0.043	117	900.540	88	0.900	886.62	101.8	5.217
50	0.043	117	906.115	92	0.900	886.62	100.7	5.166
60	0.043	116	911.715	91	0.900	885.85	101.1	5.198
70	0.043	113	917.310	92	0.900	883.54	100.4	5.184
80	0.043	109	922.930	93	0.900	880.45	100.3	5.198
90	0.043	107	928.513	93	0.900	878.90	99.6	5.164
100	0.043	104	934.121	94	0.900	876.58	99.5	5.178
110	0.043	102	939.735	93	0.900	875.02	99.7	5.192
120	0.043	101	945.335	95	0.900	874.24	99.5	5.180
130	0.043	100	950.935	95	0.900	873.46	99.0	5.161
140	0.043	99	956.555	95	0.900	872.68	99.3	5.179
150	0.043	99	962.164	96	0.900	872.68	99.0	5.160
160	0.043	99	967.765	96	0.900	872.68	98.8	5.153
170	0.043	98	973.380	97	0.900	871.90	98.7	5.156
180	0.043	97	978.990	96	0.900	871.12	98.7	5.161
190	0.043	98	984.500	97	0.900	871.90	97.1	5.060
195	0.043	97	987.420	97	0.900	871.12	102.6	2.681
						0.00	0.0	0.000
220						0.00	0.0	0.000
230						0.00	0.0	0.000
240						0.00	0.0	0.000
250						0.00	0.0	0.000
260						0.00	0.0	0.000
270						0.00	0.0	0.000
280						0.00	0.0	0.000
290						0.00	0.0	0.000
300						0.00	0.0	0.000
310						0.00	0.0	0.000
320						0.00	0.0	0.000
330						0.00	0.0	0.000
340						0.00	0.0	0.000
350						0.00	0.0	0.000

METHOD 5G-1 PARTICULATE SAMPLING DATA Kuma LAB-

DATE 9/15/ 1999 PAGE 1 OF 2 MODEL # Wood Classic RUN # EPA 4

METER BOX # 511-M METER Y 1.0151 FILTER # (F) 936 (R) 935

PRE TEST LEAK RATE = .000 CFM @ -15.75 IN. HG .938/.938 FILTER SIZE: 110 mm

POST TEST LEAK RATE = .000 CFM @ -15.50 IN. HG .055/.055 PROBE LENGTH 24" glass

TIME		METER READING CU.FT.	PITOT dp	TNL TEMP. (°F)	METER TEMP. (°F)	GAS METER dh	VAC IN. Hg
CLOCK	ELAPSED						
1225	00	878.200	.043	94	83	.90	0
35	10	883.805	.043	109	83	.90	0
45	20	889.375	.043	112	85	.90	0
55	30	894.950	.043	116	87	.90	0
1305	40	900.540	.043	117	88	.90	0
15	50	906.115	.043	117	92	.90	0
25	60	911.715	.043	116	91	.90	0
35	70	917.310	.043	113	92	.90	0
45	80	922.930	.043	109	93	.90	0
55	90	928.513	.043	107	93	.90	0
1405	00	934.121	.043	104	94	.90	0
15	10	939.735	.043	102	93	.90	0
25	20	945.335	.043	101	95	.90	0
35	30	950.935	.043	100	95	.90	0
45	40	956.555	.043	99	95	.90	0
55	50	962.164	.043	99	96	.90	0
1505	60	967.765	.043	99	96	.90	0
15	70	973.380	.043	98	97	.90	0
25	80	978.990	.043	97	96	.90	0
35	90	984.500	.043	98	97	.90	0

VELOCITY TRAVERSE

POINT	LOCATION	ΔP	TEMP
N-1	0.5"	.033	99
2	1.5"	.039	99
3	4.5"	.042	99
4	5.5"	.041	99
W-1	0.5"	.039	100
2	1.5"	.042	100
3	4.5"	.042	100
4	5.5"	.040	100
		.03975	
	Avg.	.040	99.500
			559.50

Pilot Leak Check Pre ____ Post ____

Cp = 0.99

N
1
2
→ W 1 2 (3 4)
3
4

*=point of Avg. delta p

$Qs = \left(\sqrt{\frac{\Delta P \times BP}{T(°R)}}\right) \times 3167.2 =$

142.692 cfm

BP = START 28.53 in Hg
60 28.51
120 28.50
180 28.48
195 28.47

$\bar{X} = 28.498$

14.2 .2
29

METHOD 5G — PARTICULATE SAMPLING DATA — LAB-

DATE 9/15/99 PAGE 2 OF 2 MODEL # RUMA WOOD CLASSIC RUN # BDA 4

METER BOX # 571M METER Y 1.0151 FILTER # (F)936 (R)935

PRE TEST LEAK RATE = .000 CFM @ -15.75 IN. HG .938/.938 FILTER SIZE: 110 MM

POST TEST LEAK RATE = .000 CFM @ -1550 IN. HG .055/.055 PROBE LENGTH 24" GLASS

TIME		METER READING CU.FT.	PITOT dp	TNL TEMP. (°F)	METER TEMP. (°F)	GAS METER dh	VAC IN. Hg
CLOCK	ELAPSED						
1540	195	987.420	.043	97	97	.90	0
	10	(109.220)					
	20						
	30						
	40						
	50						
	60						
	70						
	80						
	90						
	00						
	10						
	20						
	30						
	40						
	50						
	60						
	70						
	80						
	90						

VELOCITY TRAVERSE

POINT	LOCATION	ΔP	TEMP
N-1	0.5"	.033	99
2	1.5"	.039	99
3	4.5"	.042	99
4	5.5"	.041	99
W-1	0.5"	.039	100
2	1.5"	.042	100
3	4.5"	.042	100
4	5.5"	.040	100
		.03975	99.500
	Avg.	.040	559.5

Pilot Leak Check Pre ✓ Post ✓

Cp = 0.99

N 1 2 3 4 → W 1 2 (3*) 4

*=point of Avg. delta p

$Qs = \left(\sqrt{\frac{(\Delta P \times BP)}{T(°R)}}\right) \times 3167.2 =$

142.692 cfm

BP = Sther 28.53 in Hg

60 28.51
120 28.50
180 28.48
195 28.47

$\bar{X}$ = 28.496

WOODSTOVE DATA SHEET #4-1: INITIAL FILTER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date 1/9/99 Time 1445 By ATM Front Half ✓ Back Half ✓

Manufacturer: Schleicher & Schuell Size: 11cm Lot.No.: Z8961 Grade: #25 Glass
Order No: 06220

	Filter #	First Wt	Date	Time	By	Second Wt	Date	Time	By	Third Wt	Date	Time	By
	926	.7740	3/6/99	1140	T/M	.7739	3/15/99	1652	ATM				
	927	.7938		1141	T/M	.7938		1651	ATM				
	928	.7985		1142	T/M	.7985		1650	ATM				
	929	.7909		1143	T/M	.7912		1649	ATM				
	930	.7948		1144	T/M	.7950		1648	ATM				
	931	.8041		1145	T/M	.8042		1647	ATM				
	932	.7917		1146	T/M	.7918		1646	ATM				
	933	.8047		1147	T/M	.8048		1645	ATM				
*	934	.7981		1148	T/M	.7918		1644	ATM	.7917	3/16/99	2130	Jm
	935	.7861		1149	T/M	.7861		1643	ATM	←			
	936	.7827		1150	T/M	.7828		1643	ATM	←			
	937	.7935		1151	T/M	.7933		1642	ATM				
	938	.8086		1152	T/M	.8084		1641	ATM				
	939	.8060		1153	T/M	.8058		1640	ATM				
	940	.8151		1154	T/M	.8151		1639	ATM				
	941	.8252		1155	T/M	.8249		1638	ATM				
	942	.7982		1156	T/M	.7983		1637	ATM				
	943	.7822		1157	T/M	.7822		1636	ATM				
*	944	.7938		1158	T/M	.7968		1635	ATM	.7968	3/16/99	2131	Jm
	945	.7944		1159	T/M	.7943		1635	ATM				
	946	.7852		1200	T/M	.7850		1634	ATM				
	947	.7731		1201	T/M	.7735		1633	ATM				
	948	.7936		1202	T/M	.7940		1632	ATM				
	949	.7838		1203	T/M	.7837		1631	ATM				
	950	.8040		1204	T/M	.8038		1630	ATM				

Checked by Jim Myers Date: 3/16/99 Time 2133

QA REWEIGH

Filter #	WT	Date	Time	By
929	.7912	3/16/99	2136	Jm
941	.8248	3/16/99	2134	Jm
949	.7837	3/16/99	2133	Jm

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
64	79	43	3/6/99	1135	ATM
66	81	45	3/15/99	1622	ATM
65	82	39	3/16/99	2025	ATM

Post Test Weighing Session Scale Check

1st	2nd	3rd	QC
0.0000	0.0000	0.0000	Δ.0001
1.0000	1.0000	1.0000	0.9999

WOODSTOVE DATA SHEET #4-2:
INITIAL BEAKER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date: 8/20/99 Time: 1500 By: A.T.Myren

Beaker #	First Wt	Date	Time	By	Second Wt	Date	Time	By	Third Wt	Date	Time	By
Glass 1	65.4841	8/27	2059	JM	65.4845	8/30/99	1211	ATM				
2	66.1509	8/27	2118	JM	66.1514		1204	ATM				
3	67.8582		2116	JM	67.8578		1207	ATM				
4	67.5890		2108	JM	67.5891		1210	ATM				
6	67.4270		2119	JM	67.4274		1213	ATM				
7	65.5444		2105	JM	65.5446		1220	ATM				
8	66.0219		2121	JM	66.0218		1205	ATM				
9	66.9297		2120	JM	66.9296		1215	ATM				
10	66.0906		2114	JM	66.0902		1209	ATM				
11	65.7072		2112	JM	65.7020		1217	ATM	65.7028	9/8/99	1717	JM
13	57.8946	↓	2110	JM	57.8948	↓	1218	ATM				
									65.7021	9/11	1232	ATM
									65.7022	9/13	1934	JM
SS 20	73.3159	8/27	2125	JM	73.3160	8/31/99	1320	ATM				
21	71.0002	8/27	2126	JM	71.0003	↓	1325	ATM				
22	71.8322	9/11/99	1240	ATM	71.8322	9/13	1719	JM				
23	70.7376	8/27	2131	JM	70.7382	8/30/99	1259	ATM	70.7376	9/8	1715	JM
24	73.2173	8/27	2130	JM	73.2182	↓	1301	ATM	73.2176	9/8	1713	JM
25					72.6505	↓	1257	ATM	72.6504	9/8	1716	JM
26	71.7865	8/27	2132	JM	71.7868	8/31/99	1322	ATM				
27	72.3294	9/11/99	1235	ATM	72.3294	9/8	1718	JM				
28	70.5955	8/27	2127	JM	70.5956	8/31/99	1324	ATM	←			
29	71.5183	8/27	2133	JM	71.5185	↓	1318	ATM				
30	70.7845	8/27	2128	JM	70.7855	8/30/99	1302	ATM	70.7851	9/8	1714	JM
31	69.6655	8/27	2129	JM	69.6655	8/31/99	1327	ATM				
cnt. 23	70.7375	9/11	1239	ATM								
cnt 24	73.2175	9/11	1242	ATM								

Checked By: A.T.Myren Date: 9/11&13/99 Time: ATM

QA REWEIGH

Beaker #	WT	Date	Time	By

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
68	83	46	8/27/99	2052	ATM
67	81	48	8/30/99	1154	ATM
63	76	48	8/31/99	1310	ATM
70	84	47	9/8/99	1705	ATM
69	84	46	9/11/99	1202	ATM
74	77	49	9/13/99	1926	ATM

WOODSTOVE DATA SHEET #4-2:
INITIAL BEAKER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date: 6/1/99 Time: 1400 By: A.T.Myren

Beaker #	First Wt	Date	Time	By	Second Wt	Date	Time	By	Third Wt	Date	Time	By
1	65.4847	7/17/99	1636	OBM	65.4847	7/18/99	1612	ATM	← B KAN			
2	66.1504		1638	OBM	66.1506	↓	1614	ATM	7/	18/99		
3	67.8572		1640	OBM	67.8567	↓	1616	ATM				
4	67.5881		1642	OBM	67.5880	↓	1618	ATM				
6	67.4268		1644	OBM	67.4266	↓	1620	ATM				
7	65.5436		1648	OBM	65.5437	↓	1622	ATM				
8	66.0212		1650	OBM	66.0211	↓	1623	ATM				
9	66.6294		1652	OBM	66.6295	↓	1625	ATM				
10	66.0889		1654	OBM	66.0885	↓	1627	ATM				
11	65.7015		1656	OBM	65.7013	↓	1628	ATM				
12	56.0655		1658	OBM	56.0653	↓	1632	ATM				
13	57.8948		1700	OBM	57.8944	↓	1630	ATM				

Checked By: ATMyren Date: 7/18/99 Time: 1800

QA REWEIGH

Beaker #	WT	Date	Time	By

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
65	78	49	7/17/99	1825	ATM
63	77	45	7/18/99	1604	ATM

WST5-Form9, pg1, Rev4/90
Unit Kuma Wood Classic
Run # EPA 4
Date: 9/15 '99

WOODSTOVE DATA SHEET #4-3: CONSTANT FINAL WEIGHTS

FINAL BEAKER WEIGHTS

Beaker #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
28	✓	9/17	1157	ATM	70.6031	9/18	1303	ATM	70.6030	9/19	1254	TM				

FINAL FILTER WEIGHTS

	Filter #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
E	936	.7970	9/15/99	1715	ATM	.7965	9/16	0900	ATM	.7969	9/18	1310	TM	.7968	9/25/99	3035	
R	935	.7863	9/15/99	1715	ATM	.7859	9/16	0901	ATM	.7860	9/17	2056	TM	.7858	9/18	1252	ATM

QA REWEIGH: FINAL WEIGHTS

Date	Beaker #	Final Wt	By

Date	Filter #	Final WT	By

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	1999 Date	Time	By	WB	DB	%RH
1	9/16	0845	ATM	69	84	46
2	9/17	2045	ATM	66	79	49
3	9/18	1217	ATM	65	78	48
4	9/19	1245	ATM	62	75	47
5	9/22	2003	ATM	65	79	47

SCALE ROOM ENVIRONMENTAL CONDITIONS

6						
7						
8						
9						

Comments

WOODSTOVE DATA SHEET #4-3: CONSTANT FINAL WEIGHTS

Blank
7/18/99

WST5-Form9,rg1,Rev4/90
Unit Kuma Wood Classic
Run #
Date: 91 199

FINAL BEAKER WEIGHTS

Beaker #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
1	✓	7/21/99	1435	ATM	65.4852	8/4/99	1715	ATM	65.4846	8/8/99	1742	ATM	65.4847	8/9	1642	ATM

FINAL FILTER WEIGHTS

Filter #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By

QA REWEIGH: FINAL WEIGHTS

Date	Beaker #	Final Wt	By

Date	Filter #	Final WT	By

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	1999 Date	Time	By	WB	DB	%RH
1	8/4	1705	ATM	69	83	49
2	8/8	1700	ATM	64	78	46
3	8/9	1615	ATM	69	84	46
4						
5						

SCALE ROOM ENVIRONMENTAL CONDITIONS

6						
7						
8						
9						

Comments

WOODSTOVE DATA SHEET #4-4
SCALE QA SHEET

Dates From 1/9/99
Through 7/17/99

Scale Mettler
Model AE100
SN K04827

Level	Recalibrated	100g Weight	10g Weight	1.0g Weight	100mg Weight	20mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	Yes P.O.	99.9999	10.0001	1.0002	.1003	.0203	1/9/99	1243	ATM	58	70	48
✓	No	100.0002	10.0000	1.0000	.1000	.0200	1/14/99	1113	ATM	62	75	47
✓	YES P.O.	99.9998	10.0002	1.0000	.0999	.0201	1/23/99	1100	ATM	63	77	48
✓	YES	99.9999	10.0000	1.0000	.1000	.0201	1/24/99	1318	ATM	59	74	45
✓	YES	99.9996	10.0002	1.0000	.1000	.0200	2/1/99	0910	ATM	55	69	39
✓	YES	99.9997	10.0001	1.0001	.1002	.0201	2/2/99	0939	ATM	60	73	46
✓	YES	99.9999	10.0001	1.0001	.1001	.0200	2/3/99	1555	ATM	63	76	48
✓	YES	99.9999	10.0000	1.0001	.1001	.0201	2/7/99	1235	ATM	62	76	45
✓	YES	99.9998	10.0000	1.0000	.1000	.0200	2/10/99	1600	ATM	63	77	43
✓	YES	99.9998	10.0000	1.0001	.1000	.0200	2/19/99	0246	ATM	64	78	46
✓	NO	99.9999	10.0000	1.0000	.1000	.0200	2/21/99	1312	ATM	65	80	44
✓	No	99.9997	10.0000	1.0001	.1000	.0200	3/5/99	1935	ATM	64	80	41
✓	YES P.O.	99.9997	10.0000	1.0000	.1001	.0200	3/6/99	1133	ATM	64	79	43
✓	YES	99.9997	10.0000	1.0001	.1000	.0200	3/13/99	1526	ATM	65	80	44
✓	YES	99.9999	10.0001	1.0001	.1001	.0200	3/14/99	1355	ATM	63	78	43
✓	NO	100.0001	10.0000	1.0000	.1000	.0200	3/15/99	1623	ATM	66	81	45
✓	Yes	99.9997	10.0000	1.0001	.1000	.0200	3/16/99	2025	ATM	65	82	39
✓	Yes	99.9996	10.0000	1.0001	.1001	.0200	3/17/99	1615	ATM	62	77	42
✓	Yes	99.9997	10.0000	1.0001	.1000	.0200	3/18/99	2140	ATM	68	84	43
✓	Yes	99.9998	10.0000	1.0000	.1000	.0200	3/20/99	1300	ATM	64	84	32
✓	Yes	99.9999	10.0000	1.0001	.1001	.0201	3/21/99	2215	ATM	61	74	47
✓	Yes	99.9997	10.0000	1.0000	.1001	.0200	3/22/99	0102	ATM	65	85	33
✓	Yes	99.9997	10.0000	1.0001	.1000	.0200	3/23/99	1115	ATM	69	84	46
✓	Yes	99.9998	10.0000	1.0002	.1001	.0201	3/24/99	1120	ATM	72	89	43
✓	Yes	99.9999	10.0000	1.0002	.1001	.0201	3/29/99	2038	ATM	69	72	45
✓	NO	99.9999	10.0002	1.0002	.1001	.0202	3/30/99	0610	ATM	66	80	47
✓	No	99.9999	10.0000	1.0000	.1001	.0201	3/31/99	1000	ATM	64	80	41
✓	NO	99.9996	10.0000	1.0000	.1001	.0201	4/6/99	1730	ATM	64	80	41
✓	Yes	99.9998	10.0001	1.0001	.1001	.0201	4/6/99	1030	ATM	61	75	44
QC Services		Audit	4/6/97	- wt.	Scale check after audit							
✓	NO	100.0003	10.0001	1.0001	.1001	.0201	4/6/99	1730	ATM			
✓	YES	99.9998	10.0001	1.0001	.1001	.0200	4/8/99	1424	ATM	65	85	33
✓	NO	99.9996	10.0000	1.0001	.1001	.0201	4/8/99	1346	ATM	67	80	50
✓	YES	99.9997	10.0000	1.0000	.1000	.0200	4/16/99	1230	ATM	66	82	43
✓	YES	99.9997	10.0000	1.0000	.1000	.0200	4/17/99	1625	ATM	68	84	43
✓	No	99.9999	10.0000	.9998	.0999	.0198	6/9/99	1050	ATM	49	72	45
✓	yes	99.9996	10.0001	1.0002	.1001	.0202	7/17/99	1625	ATM	65	78	49

WOODSTOVE DATA SHEET #4-4
SCALE QA SHEET

Dates From 7/18/99
Through 9/16/99

Scale Mettler
Model AE100
SN K04827

Level	Recalibrated	100g Weight	10g Weight	1.0g Weight	100mg Weight	20mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	No	99.9996	10.0000	1.0001	.1000	.0201	7/18/99	1604	ATM	63	77	45
✓	YES	99.9997	10.0000	1.0001	.1001	.0201	7/19/99	1835	ATM	64	77	49
✓	Yes	99.9996	10.0000	1.0002	.1002	.0202	7/20/99	1854	ATM	71	85	80
✓	Yes	99.9997	10.0001	1.0001	.1001	.0201	7/21/99	1306	ATM	69	84	50
✓	Yes P.O.	99.9996	9.9999	1.0000	.1000	.0200	7/22/99	2145	ATM	64	80	41
✓	Yes	99.9998	10.0000	1.0000	.1000	.0200	7/23/99	0745	ATM	62	76	45
✓	No	99.9998	10.0000	1.0000	.1000	.0200	7/24/99	1340	ATM	66	80	47
✓	YES P.O.	Would not calibrate					8/3/99	2117	ATM	70	84	49
✓	Yes	99.9998	10.0001	1.0002	.1000	.0201	8/4/99	1705	ATM	69	83	49
✓	NO	99.9998	10.0001	1.0001	.1000	.0200	8/5/99	2106	ATM	65	78	49
✓	Yes	99.9998	10.0000	1.0000	.1000	.0200	8/6/99	1536	ATM	68	81	50
✓	No	99.9999	10.0000	1.0001	.1000	.0200	8/7/99	1515	ATM	66	80	47
✓	Yes	99.9996	10.0001	1.0002	.1001	.0201	8/8/99	1700	ATM	64	78	46
✓	Yes	99.9997	10.0000	1.0001	.1000	.0200	8/9/99	1225	ATM	68	82	48
✓	Yes	99.9998	10.0001	1.0001	.1001	.0200	8/9/99	1615	ATM	69	84	46
✓	No	99.9997	10.0000	1.0000	.1000	.0200	8/10/99	1327	ATM	70	84	49
✓	Yes	99.9998	10.0000	1.0000	.1001	.0200	8/11/99	1043	ATM	67	81	48
✓	Yes	99.9996	10.0000	1.0001	.1001	.0201	8/11/99	2035	ATM	64	78	46
✓	Yes	99.9997	10.0000	1.0001	.1000	.0200	8/13/99	1230	ATM	64	80	47
✓	Yes	99.9998	10.0001	1.0002	.1002	.0201	8/14/99	1929	ATM	63	76	48
✓	Yes	99.9998	10.0000	1.0001	.1001	.0201	8/16/99	1135	ATM	64	77	48
✓	Yes	99.9998	10.0001	1.0001	.1001	.0201	8/17/99	1750	ATM	68	83	46
✓	Yes	99.9998	10.0000	1.0001	.1001	.0200	8/17/99	1650	ATM	70	84	47
✓	No	99.9999	10.0001	1.0000	.1000	.0201	8/22/99	2052	ATM	68	83	46
✓	NO	99.9999	10.0001	1.0002	.1001	.0202	8/30/99	1154	ATM	67	81	48
✓	No	99.9998	9.9999	1.0000	.1000	.0200	8/31/99	1310	ATM	63	76	48
✓	Yes	99.9997	10.0000	1.0000	.1000	.0200	8/31/99	1844	ATM	65	79	44
✓	Yes	99.9998	10.0000	1.0000	.1000	.0200	9/2/99	1032	ATM	60	74	43
✓	Yes	99.9998	10.0000	1.0002	.1002	.0200	9/8/99	1705	ATM	70	84	47
✓	YES	99.9996	10.0001	1.0002	.1001	.0201	9/11/99	1202	ATM	69	84	46
✓	Yes	99.9996	10.0000	1.0001	.1001	.0201	9/12/99	2058	ATM	70	84	49
✓	Yes	99.9996	10.0001	1.0002	.1000	.0201	9/13/99	1926	ATM	64	77	49
✓	Yes	99.9997	10.0001	1.0002	.1002	.0202	9/14/99	1635	ATM	81	72	63
✓	Yes	99.9996	10.0001	1.0002	.1002	.0201	9/14/99	2025	ATM	84	68	44
✓	Yes	99.9998	10.0001	1.0000	.1001	.0200	9/15/99	0820	ATM	82	66	42
✓	Yes	99.9996	10.0001	1.0001	.1001	.0201	9/16/99	0845	ATM	84	84	46
✓	No	99.9996	10.0000	1.0000	.1000	.0200	9/16/99	1655	ATM	70	84	49

WST7-Form1-Rev8/96

Dates From 9/17/99

Through _____

WOODSTOVE DATA SHEET #4-4
SCALE QA SHEET

Scale Mettler
Model AE100
SN K04827

Level	Recalibrated	100g Weight	10g Weight	1.0g Weight	100mg Weight	20mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	Yes	99.9998	10.0000	1.0001	.1001	.0201	9/17/99	2045	ATM	66	79	49
✓	Yes	99.9997	10.0000	1.0000	.1001	.0200	9/18/99	1217	ATM	65	78	48
✓	No	99.9996	10.0000	1.0000	.1000	.0200	9/19/99	1245	ATM	62	75	49
✓	Yes	99.9998	10.0001	1.0001	.1001	.0201	9/23/99	2028	ATM	65	79	47
✓	Yes	99.9997	10.0000	1.0000	.1000	.0201	9/24/99	1145	ATM	64	77	49

Unit: Kuma Wood Classic
Run: EPA 4
Date: 9/15/1999
Technicians: AJM RLS
WST20, Form5

Woodstove Particulate Catch Processing Sheet
Woodstove Data Sheet #5
EPA M5G-1

Filters

Filter #	(F) 936	Beaker #	28	Final Wt.	70,6030 g
Final Wt	.7968 g	Ml	40	Tare Wt.	70,5956 g
Tare Wt	.7828 g	Desc.	Acetone	Net Wt.	.0074 g
Net Wt	.0140 g				

Filter #	(R) 935	Beaker #		Final Wt.	g
Final Wt	.7858 g	Ml		Tare Wt.	g
Tare Wt	.7861 g	Desc.		Net Wt.	g
Net Wt	−.0003 g				

Acetone Blank Calculation: Blank done 7/18/99

Blank Beaker #	1	Final Wt	65,4847
Ml	50	Tare Wt	65,4847
Desc	Acetone	Net Wt	.0000

.0000 g ÷ 50 ml = .0000 g/ml

Particulate Catch Calculation

Filter: .0140 g

Filter: −.0003 g

Beakers: .0074 (Total Catch) − (.0074)(.0000) (Ml of Acetone × Blank Value/Ml of Acetone) = .0074 g

Total Catch = .0211 g

Unit Kuma Wood Classic
Run # EPA 4
Date 9/15/1999
Technician ATM PLS JP

WST6-Form1, Rev8/96

MISCELLANEOUS TEST DATA
WOODSTOVE DATA SHEET #8

Useable Firebox Dimensions: See QC Section Useable Volume: 2.228 ft³

Dilution Tunnel Draft (If applicable): Start 00.0 Stop 00.0

Test Chamber Air Velocity: Start: 00.0 Stop: 00.0 Avg: 00.0

Wet Bulb/ Start: WB: 67 °F DB: 80 °F 1.5 % Amb Moisture 50 %RH

Dry Bulb Stop: WB: 69 °F DB: 84 °F 1.85 % Amb Moisture 46 %RH

$\bar{X}$ = 1.675 % Ambient Moisture $\bar{X}$ = 48 % Relative Humidity (RH)

Empty Stove Wt: 419.3 lbs.

Empty Stove Wt with Stack (Inc. Oil Seal) Wet: 570.7 lbs. Dry: 509.2 lbs.

Empty Stove Wt with Stack and Ash Ash: — lbs. Total: — lbs.

Kindling Wt. Paper: 0.3 lbs. Wood: 4.0 lbs.

Pre Burn Fuel Wt. 14.1 + 14.1 + 14.5 Total: 42.7 lbs. ✓

Total Kindling and Pre Burn Fuel Wt 47.0 lbs. ✓

Coal Bed Wt-lbs: Range (512.8 - 512.2) 3.6 - 3.0 lbs. Actual: 3.6 lbs.

Allowable Amount of Charcoal that can be removed:

Coal Bed Wt. Range $\frac{3.6}{\text{Upper Wt.}} + \frac{3.0}{\text{Lower Wt.}} / 2 \times .25 =$ .8 lbs.

Test Fuel Wt-lbs: Ideal 15.6 lbs. Range: 17.1-14.1 lbs. Actual: 14.6 lbs.

Test Fuel Size (pcs.) (.75 x 1.5 x 5" Flanges) 16 Pcs.

2 x 4's x 15 1/4	"	3 Pcs	6.2 lbs.	42.5 % ✓
4 x 4's x 15 1/4	"	2 Pcs	8.4 lbs.	57.5 % ✓

Est. Dry Burn Rate (Kg/Hr.) $\frac{14.6 - (14.6 \times .1766)}{2.2046} \times \frac{60}{195} = 1.678$ Est. Dry Burn Rate (Kg/Hr) ✓

Est EPA Heat Output (HO_E) (Avg BTU's/Hr) (19,140) X $\frac{63}{100}$ x 1.678 = 20,232 Est Heat Output (HO_E) BTU's/Hr ✓

Comments:

Stove Operating Data
Woodstove Test Data Sheet #9
Cold Start

Unit: KUMA WOOD CLASSIC
Run: EPA 4
Date: 9/15/99
Technician(s): ATH, RLS, TP
Data Sheet #9 - Rev 1/98-Pg.2

Fire Started: 0755 P.D.S.T.

Warm up and Preburn: Primary Air: Wide open from ignition until the start of preburn when the primary air control(s) was (were) adjusted to the run setting of 11/16" OPEN. At the run setting until the start of the test.

Secondary Air:
No Controls. Naturally Drafted.

Secondary Burn/Cat Bypass:
N/A

Charcoal Bed Preparation: Broke up, raked and leveled the coal bed prior to the addition of each warm up/pre burn fuel charge. Starting 1:30 before the start of the test, broke up, raked and leveled the coal bed. In stove for 35 seconds.

Test: Door wide open during loading 1 min 01 sec, then closed. Door closed at 01:44, but then reopened to take photograph

Primary Air: Wide open during the start of the test until 4:55.
Adjusted to the run setting of 11/16" open between 4:55 and 5:00.
At the run setting of 11/16" open at 5:00 into the run.

Secondary Air: No Controls. Naturally drafted

Secondary Burn/Cat Bypass: N/A

Fan: ON/OFF during the warm up ON/OFF high during the preburn, ON/OFF at the start of the test, ON/OFF for the first 30 minutes of the test, ON/OFF high at 30 minutes into the test, ON/OFF for the rest of the test.

Test Run Anomalies: None

Unit Kuma Model Classic
Run # EPA 4
Date 9/15/1999
Technician ATM RLS, I.P.
Page 1 of 4
WST7-Form2-A, Rev10/88

WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-1

Wood Data: Kindling: A mix of the below grades

	Size	Mill	Grade	Species
Pre Burn	2X4	Canyon Lumber	#2 & Better	D. Fir SFC Grn
Test Fuel	2X4	Canyon Lumber	#2 & Better	D. Fir SFC Grn
	4X4	R.I.B. Const.	#1	D. Fir SFC Grn

All grades WCLB Rules unless otherwise noted.

Warm up Information:

1st Warm up/Pre Burn Fuel charge (14.1 lbs) added at 0830.
2nd Warm up/Pre Burn Fuel charge (14.1 lbs) added at 0928.
3rd Warm up/Pre Burn Fuel charge (14.5 lbs) added at 1027.
4th Warm up/Pre Burn Fuel charge (lbs) added at .
5th Warm up/Pre Burn Fuel charge (lbs) added at .
6th Warm up/Pre Burn Fuel charge (lbs) added at .
7th Warm up/Pre Burn Fuel charge (lbs) added at .
8th Warm up/Pre Burn Fuel charge (lbs) added at .

The coals were scooped out of the stove immediately prior to adding the 3 pre burn/warm up fuel charge. The stove lost 1.5 lbs. 3.0 lbs. of coals were put back in the stove after the scoop.

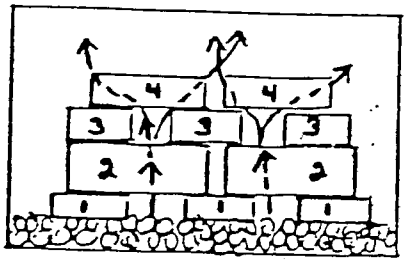
All pre burn/warm up fuel pieces were [redacted] 16" inches long. All preburn pieces/fuel charges were "ricked" in the stove. The pieces in the bottom layer in each rick contained 2 pcs that were 16 inches long and were loaded flat and perpendicular to the door. The pieces in the second layer in each rick were loaded on their side (edge) approximately parallel to the door and contained 4 pcs 16 inches long. The third layer (and fourth layer if present) was loaded flat, perpendicular to the door and contained 2 pcs 16 inches long. The majority of the pieces in each rick were in the second layer which had an approximate 0.5-1.0" space between pieces. (The loading directions indicate the direction of the longest dimension on each piece relative to the loading door opening.) Each pre burn/warm up fuel charge normally weighs within the weight range allowed for the actual test fuel charge

Unit Kuma Wood Classic
Run # EPA 4
Date 9/15/1999
Technician ATM, J.P., RLS
Page 2 of 4
WST7-Form2-A, Rev 6/90

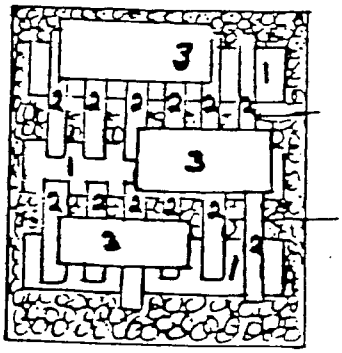
WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-2

Warm up Information (cont.):

Each warm up/preburn fuel charge was ricked in exactly (as much as possible) the same manner and the weight of each rick was usually within the allowable weight range for the test fuel charge. The physical arrangement and alignment of each rick was designed to accomplish three (3) things: (1)The bottom layer was nestled firmly into the coal bed and was as close to being level with the bottom of the stove as possible, thus providing a stable loading platform for the rest of the rick, keeping it in a ricked state (as opposed to a col- lapsed or fallen down state) untill the rick reached the charcoal stage and sags or collapses of its own accord. (2) It enhances the flow of primary air through the ricked preburn fuel charge, for the primary air would flow through the spaces between the pieces in the first layer and then up through the spaces between the pieces in the second, third and, if present, fourth layers. (3) It maximized, as much as possible, the surface to volume ratio of each preburn fuel charge, thereby allowing the fire immediate access to as much wood surface as possible and, thereby, insuring uniform charcoalization. All three of these enhance combustion and so get the stove as hot as possible during the warm up period, therby maximizing the amount of heat (BTU's) stored in the stove. The actual preburn was not started until the stove surface temperatures had maximized and stabilized, thus indicating that the amount of heat stored in the stove had peaked. For this stove, the thermal storage was monitored using the TOP surface temperature(s) and the peak value(s) obtained were 950 °F.



Front View



Top View

The arrows indicate the direction of the air flow through the rick.

The primary air was adjusted to the run setting of 11/16" open 6.7 lbs above the upper charcoal bed weight.

Unit Kuma Wood Classic
Run # EPA 4
Date 9/15/99
Technician ATM RLS JRP
Page 3 of 4
WST5-Form2-Rev11/89

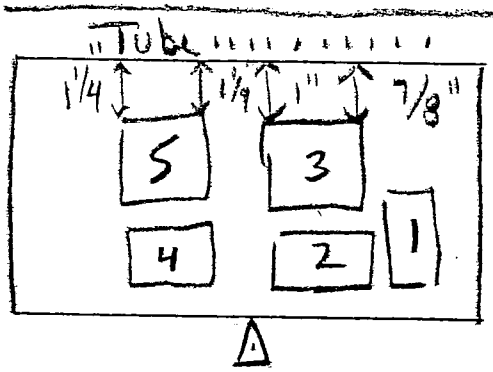
WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-3

Additional Comments: Test Start Sequence: ① Turned Fan Off. ② Opened primary air control wide Open ③ opened door ④ loaded test fuel into stove, ⑤ cleared cords away from LPAO ⑥ closed door ⑦ reopened door ⑧ Photograph ⑨ closed door again.

Total Elapsed Time: 1:01

Test Fuel Charge Loading Information:

Test Fuel Charge and Loading Sequence Diagram



Side of stove view

4 X 4's: 3 & 5

2 X 4's: 1, 2 & 4

Loading Sequence: 1, 2, 3, 4 & 5 last

Driest Pcs in Load 2 & 4, 3

Loaded the test fuel charge on an essentially level, Medium to large sized, hot coal bed (in appearance, color and temperature for a Medium high, burn rate. Ignition: 0133 Door Closed 2nd Time 1101, VC to baffle 1110 Flames on the left side of L. Stack 1125, 1139 VC curling down on tops of 3 & 5, 1145 Flames past front tube on L Side, 1216 Flames forward in center 2128 Front tube igniting CO gases high as 1.05% then ↓

(*) 3:11 Gas Balance
5100 Flames ↘ Maintained hot pocket w/ VC to baffle
Flames/secondaries above 3 & 5, Flames past front tube, Front Tube on/off, but steady, Staging on Balance, + Flames on L Side L Stack.

Unit Kuma Woodstove
Run # EPA 4
Date 9/15/99
Technician Arm RLS JRP
Page 4 of 4
WST5-Form2-Rev10/88

WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-4

Additional Comments:

6:50 Flames on front tube decreasing (↓) some.
7:03 CO ↓, was up to 0.80%,
7:30 CO ↑ ↓ ↑ ↓ ↑ ↓ - a whole series of primary, secondary flip flops. But never got out of control & Stayed in gas balance.
8:13 CO ↓ .70 / 9.4% CO_2
Steady 00%, CO_2 % slowly ↑
11:20 CO ↓, CO_2 ↑ / 10.3 / .68
11:30 Flames starting to spread over pc 1 on Rt side,
12:17 Front Tube lighting again - on/off.
14:49 11.5 / .24
16:30 13.0 / .20 — Ok from here on out,

30:00 was a CO Spike between 25 & 30 mins,
Fan on high.

Unit: Kuma Wood Classic
Run: EPA 4
Date: 9/15/1999
Technician: RTM 215 J.P.
WST1-Form7-Rev11/89

FUEL MOISTURE
WOODSTOVE TEST DATA SHEET #10

Room Temperature: 70 °F

Correction Factor: 0

NOTE: Record readings to the nearest 0.5% moisture
Uncor Values are corrected for temperature: Yes ✓. No ___
Time Test Fuel Moisture Readings taken at: 1030
Calibration Checks: X — Y — 12.5 12.5 22.0 22.5

Pc #	Dimen	Use	Top		Bottom		Side		Piece Avg
			Uncor	Cor	Uncor	Cor	Uncor	Cor	Corrected
1	2x4x8'	K	12.0	12.8	12.0	12.8	12.5	13.3	12.967
2									
3									
4	2x4x8'	P	21.0	22.6	20.5	22.0	20.0	21.4	22.000
5	"	|	19.0	20.3	20.0	21.4	19.0	20.3	20.667
6	"	|	22.0	23.7	22.0	23.7	22.0	23.7	23.700
7	"	↓	21.0	22.6	21.0	22.6	21.0	22.6	22.600
8									88.967
9									
10	2X4-15 1/4"	T	18.0	19.2	18.0	19.2	18.0	19.2	19.200
11	"	|	19.5	20.9	19.5	20.9	19.0	20.3	20.700
12	"	↓	22.0	23.7	22.0	23.7	22.0	23.7	23.700
13									
14	4X4-15 1/4"	T	18.0	19.2	19.0	20.3	19.0	20.3	19.933
15	"	↓	22.0	23.7	22.0	23.7	22.0	23.7	23.700
16									107.233
17									
18									
19	5X1.5X.75	Spacers	20.5	22.0	20.5	22.0	20.0	21.4	21.800 OUT-Spacers
20									

	Kindling	Pretest Fuel	Test Load
% Moisture - Dry Basis:	12.967%	22.242 %	21.447 %
% Moisture - Wet Basis:	11.478 %	18.195 %	17.659 %
	11.479		60

To obtain Wet from Dry: $\frac{100 \times \%\ \text{Dry Rdg.}}{100 + \%\ \text{Dry Rdg.}}$ = % Moisture, Wet Basis

Acceptable Ranges: 16-20% wet; 19-25% dry
(17.5 - 22.5 on Meter [Uncor reading] at 70°F)

Key for Use: K= Kindling P= Pretest Fuel T= Test Fuel

Unit: Kuma Wood Classic
Run#: EPA 4
Date: 9/15/1999
Technician: ATM RLS

WOOD DENSITY DETERMINATION
WOODSTOVE TEST DATA SHEET #11

WST2-form11-Rev 6/90

Wood Piece: Nominal Dimensions: 3½" x 3½" x 1½" IN ✓

Depth (D): IN 1.533 cm 3.894 ✓

Width (W): IN 3.516 cm 8.931 ✓

Length (L): 3.450 cm IN ✓
3.498 cm IN
3.458 cm IN
3.490 cm IN

Length $\bar{X}$ = IN 3.474 cm 8.824 ✓

Volume: 306.875 cm^3 ✓
(D X W X L)

MOISTURE: Room Temperature: 70 °F Correction Factor: 0

Uncorrected Meter Readings Corrected for temperature: Yes ✓ No ___

NOTE: Record moisture meter readings to the nearest 0.5%

	Uncor	Cor
Top:	19.0	20.3 %
Bottom:	19.0	20.3 %
Side:	18.5	19.8 % ✓
$\bar{X}$:		20.133 %

Avg % Moisture (Dry) 20.133 % ✓

Aug % Moisture (Wet) 16.759 % ✓

Scale: Leveled In ✓ Out ✓

Zeroed: In ✓ Out ✓

Wet Weight: 182.2 g Dry Weight: 153.4 g

% Moisture Dried Basis: 15.807 % ✓
[1 - (Dry Wt ÷ Wet Wt)] X 100

	Date	Time	Temp
Into Dryer	9/15/99	1015	214 °F
Out of Dryer	9/22/99	1555	214 °F

(Minimum Time in Dryer: 24 hrs.) Minimum Dryer Temp 100°C (212°F)

Density = 153.4 g (dry wt) ÷ 306.875 cm^3 (volume) = 0.4999 g/cm^3 ✓

Pellet Fuel Moisture Content Determination

Tare Beaker Wt. _____ g

Wet Wt: _____ g - _____ g = _____ g
Gross Wet Wt. Tare Beaker Wt. Net Wet Wt.

Dry Wt: _____ g - _____ g = _____ g
Gross Dry Wt. Tare Beaker Wt. Net Dry Wt.

% Moisture Dried Basis: _____ %
[1 - (Net Dry Wt ÷ Net Wet Wt.)] X 100

BURN RATE AND FLUE GAS DATA
WS... STOVE DATA SHEET #12
WS... Form 14 Rev 1/88

Unit: Kuma Wood Classic Date: 9/15/
Run: EPA 4
Page: 1 of 2
Technician(s): A... J.P.

END Wt: 572.8 lbs.

Minute / Time	Scale Wt	lbs left	Burn Rate	CO2 v.	CO2 %CO2	O2 v.	O2 %O2	Tel	CO v.	CO %CO	T/C(1) Bal	T/C(2) Wet Bulb	T/C(2) Dry Bulb	% H2O	T/C(3) Calc W/B	Stack	SO2 v.	SO2 PPM	Static Press.	Comments
0 / 1225	527.4	14.6	0	.265	6.58	52.4	13.09		18.6	0.95	6.9	87	130	2.8	110	385			-.045	Flow
5 / 30	526.4	13.6	1.0	.478	11.83	29.3	7.32	GAS BAL.	4.6	0.23	61.4	96	141	4.2	133	628			-.078	SO2 1.5
10 / 35	525.6	12.8	.8	.383	9.49	41.7	10.42		13.6	0.71	13.4	113	163	5.1	129	422			-.066	CO2 1.5
15 / 40	524.9	12.1	.7	.419	10.37	38.4	9.59		12.8	0.65	16.0	118	163	6.6	131	429			-.069	O2 1.5
20 / 45	524.0	11.2	.9	.539	13.33	27.6	6.90		4.3	0.23	58.0	123	170	11.5	142	468			-.072	CO 1.5
25 / 50	523.1	10.3	.9	.567	14.02	25.4	6.35		5.5	0.29	48.4	126	175	12.0	143	486			-.072	
30 / 55	522.2	9.4	.9	.610	15.08	20.6	5.15		9.5	0.49	30.8	128	181	12.5	145	504			-.075	
35 / 1300	521.3	8.5	.9	.589	14.57	22.6	5.65		9.1	0.47	31.0	128	185	12.5	145	499			-.074	
40 / 05	520.5	7.7	.8	.592	14.64	22.8	5.70		5.5	0.29	40.5	127	185	12.0	144	501			-.073	
45 / 10	519.6	6.8	.9	.615	15.21	20.2	5.05		9.0	0.46	33.1	127	188	12.0	145	509			-.074	
50 / 15	518.8	6.0	.8	.600	14.84	22.6	5.65		3.0	0.16	92.7	126	187	11.5	144	502			-.073	
55 / 20	518.0	5.2	.8	.686	14.49	23.5	5.87		2.6	0.14	103.5	125	185	11.5	141	490			-.072	
																(5623) ✓			(.843)	Flow
60 / 25	517.3	4.5	.7	.568	14.05	24.9	6.22		1.8	0.10	140.5	123	183	11.0	141	479			-.071	SO2 1.5
65 / 30	516.7	3.9	.6	.515	12.74	29.5	7.37		3.3	0.17	74.9	122	178	10.5	140	458			-.068	CO2 1.5
70 / 35	516.2	3.4	.5	.424	10.50	38.6	9.64		3.4	0.18	58.3	117	171	8.5	134	427			-.064	O2 1.5
75 / 40	515.8	3.0	.4	.393	9.73	40.6	10.14		4.0	0.22	44.2	114	165	8	133	407			-.062	CO 1.5
80 / 45	515.5	2.7	.3	.359	8.90	44.2	11.04		6.9	0.35	25.4	110	159	6.8	130	386			-.060	
85 / 50	515.2	2.4	.3	.335	8.30	46.5	11.62		6.4	0.33	25.2	105	152	5.9	125	366			-.057	
90 / 55	514.9	2.1	.3	.328	8.13	47.0	11.74		7.6	0.40	20.3	103	149	5.6	123	355			-.055	
95 / 1400	514.7	1.9	.2	.279	6.92	51.2	12.79		12.8	0.66	10.5	100	145	4.9	121	341			-.053	
100 / 05	514.6	1.8	.1	.266	6.60	52.5	13.12	OUT BRN.	17.7	0.89	7.4	98	142	4.6	119	329			-.050	
105 / 10	514.4	1.6	.2	.336	8.86	54.9	13.71		20.6	1.04	5.6	95	139	4.0	116	315			-.050	
110 / 15	514.3	1.5	.1	.213	5.30	56.7	14.17		22.8	1.14	4.6	92	135	3.6	113	303			-.047	
115 / 20	514.2	1.4	.1	.212	5.27	56.8	14.19		22.9	1.15	4.6	90	133	3.2	112	296			-.046	
																(4462) ✓			(.683)	
																10,085			1,524	

BURN RATE AND FLUE GAS DATA
WOODSTOVE DATA SHEET #12
WST2-Form 14 Rev 1/88
END WT.: 512.8 lbs.

Unit: KUMA WOOD CLASSIC Date: 9/15/99
Run: EPA 4 Technician(s): ATM, RLS, J.P.
Page: 2 of 2

Minute / Time	Scale Wt	lbs left	Burn Rate	1 CO_2 v.	1 CO_2 %CO_2	2 O_2 v.	2 O_2 %O_2	Tel	3 CO v.	3 CO %CO	T/C(1)T/C(2) Bal	T/C(1)T/C(2) Wet Bulb	T/C(1)T/C(2) Dry Bulb	% H_2O	T/C(3) Calc W/B	T/C(3) Stack	4 SO_2 v.	4 SO_2 PPM	Static Press.	Comments
120 / 1425	514.1	1.3	.1	.209	5.20	57.4	14.34		22.2	1.12	4.6	89	131	3.1	111	289			-.045	Flow
125 / 30	514.0	1.2	.1	.192	4.78	58.9	14.71		24.7	1.25	3.8	88	130	3.1	110	281			-.043	SO_2 1.5
130 / 35	513.9	1.1	.1	.190	4.73	59.2	14.79		26.8	1.35	3.5	88	129	3.1	110	277			-.043	O_2 1.5
135 / 40	513.8	1.0	.1	.195	4.85	58.4	14.59		25.7	1.28	3.8	87	128	2.9	109	273			-.042	CO 1.5
140 / 45	513.7	.9	.1	.197	4.90	58.4	14.59		27.6	1.40	3.5	87	127	2.9	108	270			-.042	
145 / 50	513.7	.9	0	.209	5.20	57.2	14.29		26.6	1.34	3.9	87	128	2.9	107	267			-.041	
150 / 55	513.6	.8	.1	.196	4.88	58.5	14.61		29.2	1.46	3.3	87	127	2.9	107	263			-.040	
155 / 1500	513.5	.7	.1	.194	4.83	58.4	14.59		29.1	1.45	3.3	87	126	2.9	106	259			-.039	
160 / 05	513.4	.6	.1	.177	4.41	59.7	14.91		31.1	1.55	2.8	87	125	2.9	106	255			-.038	
165 / 10	513.3	.5	.1	.184	4.58	58.8	14.69		32.7	1.61	2.8	87	125	2.9	106	251			-.037	
170 / 15	513.2	.4	.1	.185	4.61	58.9	14.71		31.6	1.60	2.9	87	124	3.0	107	249			-.037	
175 / 20	513.2	.4	0	.183	4.56	59.6	14.89		29.7	1.49	3.1	86	123	2.9	106	246			-.037	
																3180 ✓			.484	Flow
180 / 25	513.1	.3	.1	.186	4.63	59.0	14.74		29.6	1.48	3.1	86	123	2.9	105	244			-.037	SO_2 1.5
185 / 30	513.0	.2	.1	.187	4.65	58.9	14.71		30.0	1.50	3.1	87	124	2.9	105	243			-.036	O_2 1.5
190 / 35	512.9	.1	.1	.187	4.65	58.9	14.71		30.1	1.51	3.1	87	123	3.0	105	241			-.035	CO 1.5
195 / 40	512.8	0	.1	.186	4.63	59.0	14.74		30.4	1.54	3.0	87	122	3.1	105	240			-.035	
200 / 45																968 ✓			.143	
205 / 50																				
210 / 55														40÷		14,233 ✓			2.153	
215 / 1600																				
220 / 05																356 ✓			.054	
225 / 10																				
230 / 15																				
235 / 20																				

Pre Burn Stack Wt. 617 lbs. Tare Wt. lbs.
Test Stack wt. Range 512.8 - 512.2 lbs.

PRE BURN DATA
RECORD SHEET #13
WST2-Form16

BARO. PRESSURE 28.53 " Hg

Unit: Kuma Wood Classic Date: 9/15/1C
Run: EPA 4 Technician(s): ATM RHS JP
Page: 1 of 1

Peak 3 #17

Minute Time	Scale Weight	Burn Rate	Stack	Stove Top	Left Side	Back	Right Side	Bottom	Firebox	2nd Burn ~~Catalytic~~	Room Temp	Static	Comments
			T/C#-3	4	5	6	7	8	9	10	11		Hot Box On
0 1050	579.5	0	662	919	581	425	581	499	1009	1612	71	-.090	1 1/16" FROM SIDE
5 55	578.6	.9	567	854	602	393	602	496	973	1434	70	-.083	Primary Air Set at "1/16" OPEN
10 1100	577.6	1.0	545	814	616	369	611	491	988	1483	71	-.081	Secondary Air Set at N/A
15 05	576.7	.9	541	817	624	355	615	484	1023	1482	73	-.080	Fan: ON HIGH
20 10	576.0	.7	510	783	629	349	621	478	1120	1503	72	-.077	Tunnel on at: 1052
25 15	575.3	.7	477	737	636	348	628	471	1049	1472	72	-.074	Bucket IN
30 20	574.7	.6	445	673	641	349	631	464	1021	1303	73	-.070	Analyzers Spanned RATE COALS
35 25	574.4	.3	428	628	646	354	632	460	1024	1417	72	-.070	Pumps turned on at: 1120
40 30	574.1	.3	406	605	642	352	622	455	1035	1232	73	-.065	544.0 ΔT
45 35	573.9	.2	374	549	632	348	608	450	992	1133	72	-.060	Check WB/DB: 82/97 617.4
50 40	573.7	.2	355	509	620	345	594	447	953	1092	73	-.057	
55 45	573.7	0	338	477	604	343	579	444	920	1042	71	-.054	489.4
													Probe IN Tunnel
60 50	573.5	.2	326	456	589	339	566	444	903	1026	73	-.052	478.8
65 55	573.4	.1	317	440	576	333	554	443	885	1007	73	-.051	469.2
70 1200	573.3	.1	309	427	562	326	545	442	869	991	74	-.049	460.4
75 05	573.2	.1	305	415	550	322	535	442	857	982	74	-.048	452.8
80 10	573.1	.1	299	407	540	320	525	442	848	968	73	-.048	446.8
85 15	573.0	.1	293	400	531	313	518	442	843	958	74	-.047	440.8
90 20	572.9	.1	289	391	522	307	512	441	838	949	75	-.046	
95 25	572.8	.1	285	383	514	300	506	440	833	941	74	-.045	✓ 428.6
100 30													

TEMPERATURES
RECORD SHEET #14
WST2-Form14 Rev7/96

Unit: Kuma Wood Classic Date: 9/15/97
Run: EPA 4 Technician(s): ATM, J.P., DLS
Page: 1 of 2 Rev 2 NC

T/C#	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Minute / Time	Stove Top	Left Side	Back	Right Side	Bottom	Firebox	2nd Burn [redacted]	Room Temp	Tunnel	C. Gas Box	Impinger Out	5G-1 Filter	5G-1 Condenser	[redacted]	HOT BOX
0 / 1225	383	514	300	506	440	833	941	74	94	249	39	78	53	878	249
5 / 30	397	503	318	496	442	716	1063	74	115	249	39	81	36	1167	248
10 / 35	543	501	314	480	442	717	1255	74	109	250	39	84	36	1065	249
15 / 40	577	497	312	468	441	721	1411	74	109	250	39	85	36	1077	250
20 / 45	630	499	311	466	439	741	1578	74	112	250	39	86	36	1038	250
25 / 50	684	509	311	477	435	783	1578	75	114	250	39	87	36	1072	250
30 / 55	724	521	313	491	433	827	1650	75	116	250	39	88	36	1104	250
35 / 1300	733	546	302	517	430	865	1615	76	117	250	39	88	36	1113	250
40 / 05	726	565	295	534	429	918	1650	75	117	250	39	88	36	1132	250
45 / 10	741	578	291	548	428	1027	1337	75	118	250	39	88	36	1159	250
50 / 15	740	590	291	563	428	1055	1324	76	117	250	39	88	36	1185	250
55 / 20	724	601	294	577	429	1034	1284	77	117	250	39	88	36	1242	249
	7602	6424	3652	6123	6216	16,337	16,561	899							
60 / 25	708	611	300	589	430	1155	1279	76	116	250	40	88	36	1254	249
65 / 30	685	618	307	597	432	1072	1275	76	115	250	40	88	36	1276	250
70 / 35	637	620	313	605	434	983	1250	77	113	249	40	88	36	1245	250
75 / 40	594	618	316	606	436	960	1242	76	111	249	40	88	36	1195	250
80 / 45	569	611	319	600	439	969	1199	76	109	249	40	88	37	1234	249
85 / 50	543	601	322	590	442	944	1191	77	107	250	39	88	37	1246	249
90 / 55	529	593	324	584	444	942	1169	77	107	250	39	88	37	1246	249
95 / 1400	499	585	327	577	447	992	1097	78	105	250	38	88	36	1201	249
100 / 05	474	579	327	567	448	998	1044	77	104	250	38	88	36	1171	250
105 / 10	445	573	324	553	449	999	1002	78	103	250	38	88	36	1073	250
110 / 15	424	564	319	541	450	958	961	78	102	250	38	88	36	1013	250
116 / 20	408	555	313	529	450	949	942	77	102	250	38	88	36	1000	250
	6515	7128	3811	6938	5301	11,921	13,651	923							
	14,117	13,552	7463	13,061	10,517	28,258	30,247	1822							

TEMPERATURES
RECORD SHEET #14
WST2-Form14 Rev7/96

Unit: Kuma Wood Classic Date: 9/15/99
Run: EPA 4 Technician(s): ATH, RLS, J.P.
Page: 2 of 2

T/C#	4	5	6	7	8	9	10	11	12	13	14	15	16	17 (REAR 2nd RUN)	18
Minute / Time	Stove Top	Left Side	Back	Right Side	Bottom	Firebox	2nd Burn ~~Catalytic~~	Room Temp	Tunnel	C. Gas Box	Impinger Out	5G-1 Filter	5G-1 Condenser	~~Con~~ der	HOT BOX
120 1425	396	546	308	517	448	935	932	77	101	250	39	88	36	926	250
125 30	387	537	303	506	446	899	906	78	101	250	39	88	37	925	250
130 35	377	528	298	496	443	884	885	78	100	250	39	88	37	906	250
135 40	368	517	293	486	441	877	877	77	100	250	39	88	37	902	250
140 45	362	507	288	477	438	865	875	78	99	250	39	88	37	905	250
145 50	357	499	283	469	435	864	868	78	99	250	39	88	37	883	250
150 55	352	491	281	463	433	844	856	78	99	250	39	88	37	857	250
155 1600	348	484	277	457	431	826	842	77	99	250	39	88	37	843	250
160 05	342	477	274	451	429	795	817	79	99	249	39	89	37	820	250
165 10	337	469	271	445	426	782	810	78	98	249	39	89	37	822	249
170 15	332	461	270	439	422	772	800	78	98	249	39	89	37	835	250
175 20	329	455	269	435	419	783	794	78	98	249	39	89	37	832	249
	4287	5971	3415	5641	5211	10,126	10,262	934							
180 25	324	448	267	431	415	796	790	79	97	249	39	89	37	832	249
185 30	322	442	265	427	414	800	784	79	97	249	39	89	37	822	249
190 35	322	438	264	425	412	794	776	78	98	249	39	89	37	823	250
195 40	318	434	263	422	409	799	771	80	97	249	39	89	37	824	250
200 45	1281	1762	1059	1705	1650	3189	3121	316							
205 50															
210 55	4,160	21,285	11,937	20,407	17,378	35,473	43,600	3072	40°	AVG. STOVE TEMP. CHANGE			START:	428.6	✓
215 1600													STOP:	369.2	✓
220 05	492	632	298	610	434	887	1090	77					ΔT:	-59.4	✓
225 10															
230 15															
235 20															

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-1

Site: Myren Consulting, Woodinville, WA Date: 9/15/99 Analyte: CO_2

Source: Kuma Wood Classic Run #: EPA 4

Zero Cyl #: 719 430 Conc. 00.0 % CO_2 Cyl Press: 1850 psi

Certified by: Oxarc Date: 4/1/99

Span Cyl #: 350 - 794 Conc. 12.5 % CO_2 Cyl Press: 1310 psi

Certified by: Oxarc Date: 3/26/99

Analyzer: Make: Horiba Model: PIR-2000 SN: 607024

Range: 0 - 25.0% CO_2 Analyzer Output: 0 - 1.0 v.

Flow: 1.5 SCFH Measured by: Rotameter: X Flowmeter:

EPA Span Value = 25.0% CO_2

EPA Control Limits = ± 2.5% of 25.0% CO_2 = ± 0.625% CO_2

Pre Run Audit: By: RLS Time: 1110 Temp: 72 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	.000	00.0	00.0	.000	.0446	+0.0446	+0.18
Span	50.0	.500	12.5	49.4	.491	12.1492	-0.3508	-2.81

Comments:

Post Run Audit: By: RLS Time: 1655 Temp: 78 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	.000	00.0	00.0	.000	.0446	+0.0446	+0.18
Span	50.0	.500	12.5	49.4	.488	12.0953	-0.4247	-3.40

Comments:

± Conc. Difference = Act % - Exp (Std) %

Zero % Differece = $\frac{\text{Act \% (ppm)} - \text{Exp \% (ppm)}}{\text{Full Scale Value}} \times 100$

Span % Difference = $\frac{\text{Act \% (ppm)} - \text{Exp \% (ppm)}}{\text{Exp \% (ppm)}} \times 100$

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-2

Site: Myren Consulting, Woodinville, WA Date: 9/15/99 Analyte: O_2

Source: [illegible] Run #: EPA 4

Zero Cyl #: 719 430 Conc. 00.0 % O_2 Cyl Press: 1850 psi

Certified by: Oxarc Date: 4/1/99

Span Cyl #: 250-794 Conc. 12.5 % O_2 Cyl Press: 1310 psi

Certified by: Oxarc Date: 3/26/99

Analyzer: Make: Taylor Model: OA 137 SN: 137/4772

Range: 0 - 25.0% O_2 Analyzer Output: 0 - 100 mv.

Flow: 1.5 SCFH Measured by: Rotameter: X Flowmeter:

EPA Span Value = 25.0% O_2
EPA Control Limits = ± 2.5% of 25.0% O_2 = ± 0.625% O_2

Pre Run Audit: By: RLS Time: 1110 Temp: 72 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	00.0	00.1	0.0300	+0.0300	+0.12
Span	12.5	50.0	12.5	12.5	49.4	12.3409	-0.1591	-1.27

Comments:

Post Run Audit: By: RLS Time: 1555 Temp.: 78 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	00.0	00.0	.0050	+0.0050	+0.02
Span	12.5	50.0	12.5	12.5	49.4	12.3409	-0.1591	-1.27

Comments:

± Conc. Difference = Act % - Exp (Std) %

Zero % Differece = $\frac{\text{Act \% (ppm)} - \text{Exp \% (ppm)}}{\text{Full Scale Value}} \times 100$

Span % Difference = $\frac{\text{Act \% (ppm)} - \text{Exp \% (ppm)}}{\text{Exp \% (ppm)}} \times 100$

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-3

Site: Myren Consulting, Woodinville, WA Date: 9/15/99 Analyte: CO

Source: Kuma Wood Classic Run #: EPA 4

Zero Cyl #: 719 430 Conc. 00.0 % CO Cyl Press: 1850 psi

Certified by: Oxarc Date: 4/1/99

Span Cyl #: 250-794 Conc. 2.5 % CO Cyl Press: 1310 psi

Certified by: Oxarc Date: 3/26/99

Analyzer: Make: Infra Red Model: 702 D SN: 113

Range: 0 - 10.0% CO Analyzer Output: 0 - 100 mv.

Flow: 1.5 SCFH Measured by: Rotameter: X Flowmeter:

EPA Span Value = 5.0% CO
EPA Control Limits = +2.5% of 5.0% CO = + 0.125% CO

Pre Run Audit: By: RLS Time: 1110 Temp: 72 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	0.00	00.0	.0093	-.0093	-0.19
Span	2.50	50.0	2.50	2.50	50.0	2.4914	-.0086	-0.34

Comments:

Post Run Audit: By: RLS Time: 1555 Temp.: 78 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	0.00	00.1	.0043	-.0043	-0.09
Span	2.50	50.0	2.50	2.47	48.5	2.4164	-.0836	-3.34

Comments:

± Conc. Difference = Act % - Exp (Std) %

Zero % Differece = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}} \times 100$

Span % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Exp \% (ppm)}} \times 100$

Unit: Kuma Wood Ch
Run: EPA 4
Date: 9/15/199
Technicians: ATM / RLS
WST6-Form3-Rev11/89

QUALITY CHECKS
WOODSTOVE DATA SHEET #16

Ambient = Tr: _____ °F T/C#30: _____ °F

Thermocouple Check (at ambient): T/C#1: 66 °F; T/C#2: 66 °F;

T/C #3: 67 °F; T/C #4: 67 °F; T/C #5: 66 °F;

T/C #6: 66 °F; T/C #7: 67 °F; T/C #8: 66 °F;

T/C #9: 67 °F; T/C #10: 68 °F; T/C #11: 67 °F;

T/C #12: 66 °F; T/C #13: 66 °F; T/C #14: 66 °F;

T/C #15: 66 °F; T/C #16: 66 °F; T/C #17: 67 °F;

T/C #18: 66 °F; T/C #19: _____ °F; T/C #20: _____ °F;

T/C #21: _____ °F; T/C #22: _____ °F; T/C #23: _____ °F;

T/C #24: _____ °F; T/C #25: _____ °F; T/C #26: _____ °F;

Comments: _____

Thermocouple Readout: Pretest Zero/Span Check and Calibration:

Zero (0°F): 001 °F Adj to: 000 °F Post Test Check Zero (0°F): 001 °F % Difference +0.05 %

Span (2000°F): 1999 °F Adj to: 2000 °F Span (2000°F): 2000 °F 0

(Allowable % Difference = 1.5%. Use formulas on Woodstove Data Sheet #15 to calculate % Difference)

Thermocouple Readout Pretest Linearity Check

0°F = 000 °F; 200°F = 200 °F; 400°F = 400 °F;

600°F = 599 °F; 800°F = 800 °F; 1000°F = 1000 °F;

1200°F= 1200 °F; 1400°F = 1400 °F; 1600°F = 1599 °F

1800°F= 1800 °F; 2000°F = 2000 °F

Combustion Gas (CO_2,O_2,CO) Train Leak Check: Pre ✓ Post ✓

Draft (Static) Guage Zero Check: Pre ✓ Post ✓

Scale Check Pre (Wt, #'s): 570.7-575.7 5.0 lbs, ok (RLS)

Post (Wt, #'s): 572.4-577.4 5.0 lbs. ok (RLS)

Stack cleaned prior to the run: Yes ____ No ✓

Tunnel cleaned prior to the run: Yes ____ No ✓

DILUTION TUNNEL CALCULATIONS MYREN CONSULTING CERTIFICATION TEST DATA

3/31/96

File Name:	KumaEPA6
Stove Manufacturer:	Kuma
Model Number:	Wood Classic
Lab Name:	MYREN
Test Date:	9\17\99
Run Number:	EPA 6
Meter Box Y Factor:	1.0151
Barometric pressure (in):	28.64
Gas meter temp (ave):	85
delta H(avg):	0.900
Gas meter initial reading:	140.902
Gas meter final reading:	201.559
Front catch (acetone) mg:	10.2
first filter catch (mg):	10
second filter catch (mg):	-4.9
tunnel flow (ave cfm):	143.836
Emission Rate(g/hr):	2.343
Emission Rate(M5H) :	3.689
vs/VmTs:	0.0264
vs ave:	897.157
Tunnel average temp (°f):	133.833
Test time(min):	109
Fuel Load(lb. wet):	14.7
Wood moisture(%wet):	17.790
Burn rate(dry kg/hr):	3.017
Samp vol(scf):	57.139
front filter number	940
back filter number	939
acetone beaker number	23
PRELIMINARY RESULTS	
FINAL RESULTS	AUDITED

DATA SUMMARY

MODEL :	Wood Classic
RUN:	EPA 6
DATE:	9\17\99
DBR:	3.017
GPH UNADJ	2.343
ADJ	3.689477713

RUN TIME (min)	PITOT DELTAP (- INCH H20)	TNL TEMP (°F)	GAS METER RDG (ft3)	GAS METER TEMP (°F)	GAS METER DELTA H (in.H2O)	TUNNEL VELOCIT (ft/min)	PROP RATE (%)	dDGM vol std (ft3)
0	0.043	121	140.902	77	0.900	887.48		
10	0.043	149	146.455	78	0.900	908.61	104.9	5.306
20	0.043	154	152.005	80	0.900	912.34	102.9	5.283
30	0.043	154	157.557	83	0.900	912.34	101.9	5.256
40	0.043	150	163.135	84	0.900	909.36	101.6	5.271
50	0.043	144	168.681	86	0.900	904.88	99.9	5.221
60	0.043	135	174.240	87	0.900	898.11	99.0	5.224
70	0.043	128	179.795	88	0.900	892.81	98.3	5.211
80	0.043	122	185.364	89	0.900	888.24	98.0	5.214
90	0.043	119	191.065	89	0.900	885.95	100.3	5.338
100	0.043	116	196.537	89	0.900	883.65	96.0	5.123
109	0.043	114	201.559	90	0.900	882.12	97.6	4.693
						0.00	0.0	0.000
130						0.00	0.0	0.000
140						0.00	0.0	0.000
150						0.00	0.0	0.000
160						0.00	0.0	0.000
170						0.00	0.0	0.000
180						0.00	0.0	0.000
190						0.00	0.0	0.000
200						0.00	0.0	0.000
210						0.00	0.0	0.000
220						0.00	0.0	0.000
230						0.00	0.0	0.000
240						0.00	0.0	0.000
250						0.00	0.0	0.000
260						0.00	0.0	0.000
270						0.00	0.0	0.000
280						0.00	0.0	0.000
290						0.00	0.0	0.000
300						0.00	0.0	0.000
310						0.00	0.0	0.000
320						0.00	0.0	0.000
330						0.00	0.0	0.000
340						0.00	0.0	0.000
350						0.00	0.0	0.000

METHOD 5G-1 PARTICULATE SAMPLING DATA Kuma LAB-

DATE 9/17/ 1999 PAGE 1 OF 1 MODEL # Wood Classic RUN # EPH 6

METER BOX # 511-M METER Y 1.0151 FILTER # (F) 940 (R) 939

PRE TEST LEAK RATE = .000 CFM @ -150 IN. HG .488/.488 FILTER SIZE: 110 mm

POST TEST LEAK RATE = .000 CFM @ -14.0 IN. HG .099/.099 PROBE LENGTH 24" glass

TIME		METER READING CU.FT.	PITOT dp	TNL TEMP. (°F)	METER TEMP. (°F)	GAS METER dh	VAC IN. Hg
CLOCK	ELAPSED						
0940	00	140.402	-.043	121	77	.90	0
50	10	146.455	-.043	149	78	.90	0
1000	20	152.005	-.043	154	80	.90	0
10	30	157.557	-.043	154	83	.90	0
20	40	163.135	-.043	150	84	.90	0
30	50	168.681	-.043	144	86	.90	0
40	60	174.240	-.043	135	87	.90	0
50	70	179.795	-.043	128	88	.90	0
1100	80	185.364	-.043	122	89	.90	0
10	90	191.065	-.043	119	89	.90	0
20	100	196.537	-.043	116	89	.90	0
30	~~110~~ 101	201.559	-.043	114	90	.90	0
40	~~120~~	(60.657)					
50	30						
1200	40						
10	50						
20	60						
	70						
	80						
	90						

VELOCITY TRAVERSE

POINT	LOCATION	ΔP	TEMP
N-1	0.5"	.034	127
2	1.5"	.040	129
3	4.5"	.042	128
4	5.5"	.039	127
W-1	0.5"	.040	129
2	1.5"	.043	131
3	4.5"	.043	130
4	5.5"	.041	130
	Avg.	.040	128.875

Pilot Leak Check Pre ✓ Post ✓

Cp = 0.99

N 1 2 3 4

→ W 1 2 3* 4

*=point of Avg. delta p

$Qs = \left(\sqrt{\frac{\Delta P \times BP}{T(°R)}}\right) \times 3167.2 =$

139.719 cfm

BP = START 28.65 in Hg

60 28.64

120 28.63

180

240

300

$\bar{X} = 28.6400$

± 1%

WOODSTOVE DATA SHEET #4-1: INITIAL FILTER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date 1/9/99 Time 1445 By ATM Front Half ✓ Back Half ✓

Manufacturer: Schleicher & Schuell Size: 11 cm Lot.No.: Z8961 Grade: #25 Glass
Order No: 06220

Filter #	First Wt	Date	Time	By	Second Wt	Date	Time	By	Third Wt	Date	Time	By
926	.7740	3/6/99	1140	T.M.	.7739	3/15/99	1652	ATM				
927	.7938		1141	T.M.	.7938		1651	ATM				
928	.7985		1142	T.M.	.7985		1650	ATM				
929	.7909		1143	T.M.	.7912		1649	ATM				
930	.7948		1144	T.M.	.7950		1648	ATM				
931	.8041		1145	T.M.	.8042		1647	ATM				
932	.7917		1146	T.M.	.7918		1646	ATM				
933	.8047		1147	T.M.	.8048		1645	ATM				
* 934	.7981		1148	T.M.	.7918		1644	ATM	.7917	3/16/99	2130	JM
935	.7861		1149	T.M.	.7861		1643	ATM				
936	.7827		1150	T.M.	.7828		1643	ATM				
937	.7935		1151	T.M.	.7933		1642	ATM				
938	.8086		1152	T.M.	.8084		1641	ATM				
939	.8060		1153	T.M.	.8058		1640	ATM	←			
940	.8151		1154	T.M.	.8151		1639	ATM	←			
941	.8252		1155	T.M.	.8249		1638	ATM				
942	.7982		1156	T.M.	.7983		1637	ATM				
943	.7822		1157	T.M.	.7822		1636	ATM				
* 944	.7938		1158	T.M.	.7968		1635	ATM	.7968	3/16/99	2131	JM
945	.7944		1159	T.M.	.7943		1635	ATM				
946	.7852		1200	T.M.	.7850		1634	ATM				
947	.7731		1201	T.M.	.7735		1633	ATM				
948	.7936		1202	T.M.	.7940		1632	ATM				
949	.7838		1203	T.M.	.7837		1631	ATM				
950	.8040		1204	T.M.	.8038		1630	ATM				

Checked by JM Date: 3/16/99 Time 2133

QA REWEIGH

Filter #	WT	Date	Time	By
929	.7912	3/16/99	2136	JM
941	.8248	3/16/99	2134	JM
949	.7837	3/16/99	2133	JM

Post Test Weighing Session Scale Check QC

1st	2nd	3rd
0.0000	0.0000	0.0000	Δ .0001
1.0000	1.0000	1.0000	0.9999

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
64	79	43	3/6/99	1135	ATM
66	81	45	3/15/99	1622	ATM
65	82	39	3/16/99	2035	ATM

WOODSTOVE DATA SHEET #4-2:
INITIAL BEAKER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date: 8/20/99 Time: 1500 By: A.T.Myren

	Beaker #	First Wt	Date	Time	By	Second Wt	Date	Time	By	Third Wt	Date	Time	By
Glass	1	65.4841	8/27	2059		65.4835	8/30/99	1211	ATM				
	2	66.1509	8/27	2118		66.1514		1204	ATM				
	3	67.8582		2116		67.3578		1207	ATM				
	4	67.5890		2108		67.5891		1210	ATM				
	6	67.4270		2119		67.4274		1213	ATM				
	7	65.5444		2105		65.5446		1220	ATM				
	8	66.0219		2221		66.0218		205	ATM				
	9	66.9297		2120		66.9296		1215	ATM				
	10	66.0906		2114		66.0902		1209	ATM				
	11	65.7072		2112		65.7020		1217	ATM	65.7028	9/8/99	1717	
	13	57.8946	↓	2110		57.8948	↓	1218	ATM				
										65.7021	9/11	1232	ATM
										65.7022	9/13	1934	
SS	20	73.3159	8/27	2125		73.3160	8/31/99	1320	ATM				
	21	71.0002	8/27	2126		71.0003	↓	1325	ATM				
	22	71.8322	9/11/99	1240	ATM	71.8322	9/13	1719					
	23	70.7376	8/27	2131		70.7382	8/30/99	1259	ATM	70.7376	9/8	1715	
	24	73.2173	8/27	2130		73.2182		1301	ATM	73.2176	9/8	1713	
	25					72.6505	↓	1257	ATM	72.6504	9/8	1716	
	26	71.7865	8/27	2132		71.7868	8/31/99	1322	ATM				
	27	72.3294	9/11/99	1235	ATM	72.3294	9/8	1718					
	28	70.5955	8/27	2127		70.5956	8/31/99	1324	ATM				
	29	71.5183	8/27	2133		71.5185	↓	1319	ATM				
	30	70.7845	8/27	2128		70.7855	8/30/99	1302	ATM	70.7851	9/8	1714	
	31	69.6655	8/27	2129		69.6655	8/31/99	1327	ATM				
cont. 23	23	70.7375	9/11	1233	ATM	←	←	←					
cont 24	24	73.2175	9/11	1242	ATM								

Checked By: A.T.Myren Date: 9/11&13/99 Time: AM

QA REWEIGH

Beaker #	WT	Date	Time	By

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
68	83	46	8/27/99	2052	ATM
67	81	48	8/30/99	1154	ATM
63	76	48	8/31/99	1310	ATM
70	84	47	9/9/99	1705	ATM
69	84	46	9/11/99	1202	ATM
64	77	49	9/13/99	1926	ATM

WOODSTOVE DATA SHEET #4-2:
INITIAL BEAKER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date: 6/1/99 Time: 1400 By: A.T.Myren

Beaker #	First Wt	Date	Time	By	Second Wt	Date	Time	By	Third Wt	Date	Time	By
1	65.4847	7/17	1636	OBM	65.4847	7/18/99	1612	ATM	← B KAN			
2	66.1504		1638	OBM	66.1506	↓	1614	ATM	7/	13/99		
3	67.8572		1640	OBM	67.8567	↓	1616	ATM				
4	67.5887		1642	OBM	67.5880	↓	1618	ATM				
6	67.4268		1644	OBM	67.4266	↓	1620	ATM				
7	65.5436		1648	OBM	65.5437	↓	1622	ATM				
8	66.0212		1650	OBM	66.0211	↓	1623	ATM				
9	66.6294		1652	OBM	66.6295	↓	1625	ATM				
10	66.0889		1654	OBM	66.0886	↓	1627	ATM				
11	65.7015		1656	OBM	65.7013	↓	1628	ATM				
12	56.0655		1658	OBM	56.0653	↓	1632	ATM				
13	57.8948	↓	1700	OBM	57.8944	↓	1630	ATM				

Checked By: A.T.Myren Date: 7/18/99 Time: 1800

QA REVIEW

Beaker #	WT	Date	Time	By

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
65	78	49	7/17/99	1825	ATM
63	77	45	7/18/99	1604	ATM

WST5-Form9, rgl, Rev 4/90
Unit Kuma Wood Class C
Run # EPA 6
Date: 9/17/99

WOODSTOVE DATA SHEET #4-3: CONSTANT FINAL WEIGHTS

FINAL BEAKER WEIGHTS

Beaker #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
23	✓	9/23/99	2105	ATM	70.7477	9/24	1157	ATM	70.7476	9/27/99	2010	[illegible]				

FINAL FILTER WEIGHTS

	Filter #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
F	940	.8261	9/17	1137	ATM	.8254	9/18	1259	ATM	.8252	9/19	1305	ATM	.8251	9/23	2046	[illegible]
R	939	.8014	9/17	1138	ATM	.8010	9/18	1301	ATM	.8011	9/19	[illegible]	[illegible]	.8009	9/23	2045	[illegible]

QA REWEIGH: FINAL WEIGHTS

Date	Beaker #	Final Wt	By

Date	Filter #	Final WT	By

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	WB	DB	%RH
1	9/18	1217	ATM	65	78	48
2	9/19	1245	ATM	62	75	47
3	9/22	2058	ATM	65	79	47
4	9/24	1145	ATM	64	77	49
5						

SCALE ROOM ENVIRONMENTAL CONDITIONS

6						
7						
8						
9						

Comments

WOODSTOVE DATA SHEET #4-3: CONSTANT FINAL WEIGHTS

Blank
7/18/99

WST5-Form9,Pg1,Rev4/99
Unit Kuma Wood Classic
Run #
Date: 9/ 199

FINAL BEAKER WEIGHTS

Beaker #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
1	✓	7/21/99	1435	ATM	65.4852	8/4/99	1715	ATM	65.4846	8/8/99	1742	DBH	65.4847	8/9	1642	ATM

FINAL FILTER WEIGHTS

Filter #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By

QA REWEIGH: FINAL WEIGHTS

Date	Beaker #	Final Wt	By
Date	Filter #	Final WT	By

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	1999 Date	Time	By	WB	DB	%RH
1	8/4	1705	ATM	69	83	49
2	8/8	1700	ATM	64	78	46
3	8/9	1615	ATM	69	84	46
4						
5						

SCALE ROOM ENVIRONMENTAL CONDITIONS

6						
7						
8						
9						

Comments

WOODSTOVE DATA SHEET #4-4
SCALE QA SHEET

Dates From 1/9/99

Through 7/17/99

Scale Mettler
Model AE100
SN K04827

Level	Recalibrated	100g Weight	10g Weight	1.0g Weight	100mg Weight	20mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	Yes P.O.	99.9999	10.0001	1.0002	.1003	.0203	1/9/99	1243	ATM	58	70	48
✓	No	100.0002	10.0000	1.0000	.1000	.0200	1/14/99	1113	ATM	62	75	47
✓	YES P.O.	99.9998	10.0002	1.0000	.0999	.0201	1/23/99	1100	ATM	63	77	48
✓	YES	99.9998	10.0000	1.0000	.1000	.0201	1/24/99	1318	ATM	59	74	45
✓	YES	99.9996	10.0002	1.0000	.1000	.0200	2/1/99	0910	ATM	55	69	39
✓	YES	99.9997	10.0001	1.0001	.1002	.0201	2/2/99	0939	ATM	60	73	46
✓	YES	99.9999	10.0001	1.0001	.1001	.0200	2/3/99	1555	ATM	63	76	48
✓	YES	99.9999	10.0000	1.0001	.1001	.0201	2/7/99	1235	ATM	62	76	45
✓	YES	99.9998	10.0000	1.0000	.1000	.0200	2/10/99	1600	ATM	63	77	45
✓	YES	99.9998	10.0000	1.0001	.1000	.0200	2/19/99	0246	ATM	64	78	46
✓	NO	99.9999	10.0000	1.0000	.1000	.0200	2/21/99	1312	ATM	65	80	44
✓	NO	99.9997	10.0000	1.0001	.1000	.0200	3/5/99	1935	ATM	64	80	41
✓	YES P.O.	99.9997	10.0000	1.0000	.1001	.0200	3/6/99	1135	ATM	64	79	43
✓	YES	99.9997	10.0000	1.0001	.1000	.0200	3/13/99	1526	ATM	65	80	44
✓	YES	99.9999	10.0001	1.0001	.1001	.0200	3/14/99	1355	ATM	63	78	43
✓	NO	100.0001	10.0000	1.0000	.1000	.0200	3/15/99	1622	ATM	66	81	45
✓	Yes	99.9997	10.0000	1.0001	.1000	.0200	3/16/99	2025	ATM	65	82	39
✓	Yes	99.9996	10.0000	1.0001	.1001	.0200	3/17/99	1615	ATM	62	77	42
✓	Yes	99.9997	10.0000	1.0001	.1000	.0200	3/18/99	2140	ATM	66	84	43
✓	Yes	99.9998	10.0000	1.0000	.1000	.0200	3/20/99	1300	ATM	64	84	32
✓	Yes	99.9999	10.0000	1.0001	.1001	.0201	3/21/99	2215	ATM	61	74	47
✓	Yes	99.9997	10.0000	1.0000	.1001	.0200	3/22/99	0122	ATM	65	85	33
✓	Yes	99.9997	10.0000	1.0001	.1000	.0200	3/23/99	1115	ATM	69	84	46
✓	Yes	99.9998	10.0000	1.0002	.1001	.0201	3/24/99	1120	ATM	72	89	43
✓	Yes	99.9999	10.0000	1.0002	.1001	.0201	3/29/99	2038	ATM	69	72	45
✓	No	99.9999	10.0002	1.0002	.1001	.0202	3/30/99	0610	ATM	66	80	47
✓	No	99.9999	10.0000	1.0000	.1001	.0201	3/31/99	1000	[illegible]	64	80	41
✓	NO	99.9996	10.0000	1.0000	.1001	.0201	4/5/99	1730	ATM	64	80	41
✓	YES	99.9998	10.0001	1.0001	.1001	.0201	4/6/99	1030	ATM	61	75	44
QC Services	Audit	4/6/97	— wt. / Scale Check after audit									
✓	NO	100.0003	10.0001	1.0001	.1001	.0201	4/6/99	1730	ATM			
✓	YES	99.9998	10.0001	1.0001	.1001	.0200	4/7/99	1721	ATM	65	85	33
✓	NO	99.9996	10.0000	1.0001	.1001	.0201	4/8/99	1346	ATM	67	80	50
✓	YES	99.9997	10.0000	1.0000	.1000	.0200	4/16/99	1230	ATM	66	82	42
✓	YES	99.9997	10.0000	1.0000	.1000	.0200	4/17/99	1625	ATM	68	84	43
✓	No	99.9999	10.0000	.9998	.0999	.0198	6/9/99	1050	ATM	49	72	45
✓	Yes	99.9996	10.0001	1.0002	.1001	.0202	7/17/99	1825	ATM	65	78	49

WOODSTOVE DATA SHEET #4-4
SCALE QA SHEET

Dates From 7/18/99
Through 9/16/99

Scale Mettler
Model AE100
SN K04827

Level	Recali-brated	100g Weight	10g Weight	1.0g Weight	100mg Weight	20mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	No	99.9996	10.0000	1.0001	.1000	.0201	7/18/99	1604	ATM	63	77	45
✓	YES	99.9997	10.0000	1.0001	.1001	.0201	7/19/99	1835	ATM	64	77	49
✓	Yes	99.9996	10.0000	1.0002	.1002	.0202	7/20/99	1854	ATM	71	85	80
✓	Yes	99.9997	10.0001	1.0001	.1001	.0201	7/21/99	1306	ATM	69	84	50
✓	Yes P.O.	99.9996	9.9999	1.0000	.1000	.0200	7/22/99	2145	ATM	64	80	41
✓	Yes	99.9998	10.0000	1.0000	.1000	.0201	7/23/99	0745	ATM	62	76	45
✓	No	99.9998	10.0000	1.0000	.1000	.0200	7/24/99	1340	ATM	66	80	47
✓	YES P.O.	Would not calibrate					8/3/99	2117	ATM	70	84	49
✓	Yes	99.9998	10.0001	1.0002	.1000	.0201	8/4/99	1705	ATM	69	83	49
✓	NO	99.9998	10.0001	1.0001	.1000	.0200	8/5/99	2106	ATM	65	78	49
✓	Yes	99.9998	10.0000	1.0000	.1000	.0200	8/6/99	1536	ATM	68	81	50
✓	No	99.9999	10.0000	1.0001	.1000	.0200	8/7/99	1513	ATM	66	80	47
✓	Yes	99.9996	10.0001	1.0002	.1001	.0201	8/8/99	1700	ATM	64	78	46
✓	Yes	99.9997	10.0000	1.0001	.1000	.0200	8/9/99	1225	ATM	68	82	48
✓	Yes	99.9998	10.0001	1.0001	.1001	.0200	8/9/99	1615	ATM	69	84	46
✓	No	99.9997	10.0000	1.0000	.1000	.0200	8/10/99	1327	ATM	70	84	49
✓	Yes	99.9998	10.0000	1.0000	.1001	.0200	8/11/99	1043	ATM	67	81	48
✓	Yes	99.9996	10.0000	1.0001	.1001	.0201	8/11/99	2035	ATM	64	78	46
✓	Yes	99.9997	10.0000	1.0001	.1000	.0200	8/13/99	1230	ATM	64	80	47
✓	Yes	99.9998	10.0001	1.0002	.1002	.0201	8/14/99	1929	ATM	63	76	48
✓	Yes	99.9998	10.0000	1.0001	.1001	.0201	8/16/99	1135	ATM	64	77	48
✓	Yes	99.9998	10.0001	1.0001	.1001	.0201	8/10/99	1750	ATM	68	83	46
✓	Yes	99.9997	10.0000	1.0001	.1001	.0200	8/17/99	1650	ATM	70	84	47
✓	No	99.9999	10.0001	1.0000	.1000	.0201	3/22/99	2052	ATM	68	83	46
✓	No	99.9999	10.0001	1.0002	.1001	.0202	8/30/99	1154	ATM	67	81	48
✓	No	99.9998	9.9999	1.0000	.1000	.0200	8/31/99	1310	ATM	63	76	48
✓	Yes	99.9997	10.0000	1.0000	.1000	.0200	9/31/99	1844	ATM	65	79	44
✓	Yes	99.9998	10.0000	1.0000	.1000	.0200	9/2/99	1032	ATM	60	74	43
✓	Yes	99.9998	10.0000	1.0002	.1002	.0200	9/9/99	1705	ATM	70	84	47
✓	YES	99.9996	10.0001	1.0002	.1001	.0201	9/11/99	1202	ATM	69	84	46
✓	Yes	99.9996	10.0000	1.0001	.1001	.0201	9/12/99	2058	ATM	70	84	49
✓	Yes	99.9996	10.0001	1.0002	.1000	.0201	9/13/99	1926	ATM	64	77	44
✓	Yes	99.9997	10.0001	1.0002	.1002	.0202	9/14/99	1335	ATM	61	73	63 44
✓	Yes	99.9996	10.0001	1.0002	.1002	.0201	9/14/99	8025	ATM	84	68	44
✓	Yes	99.9998	10.0001	1.0000	.1001	.0200	9/15/99	0820	ATM	82	66	42
✓	Yes	99.9996	10.0001	1.0001	.1001	.0201	9/16/99	0845	ATM	69	84	46
✓	No	99.9996	10.0000	1.0000	.1000	.0200	9/16/99	1655	ATM	70	84	49

Dates From 9/17/99

Through _____

WOODSTOVE DATA SHEET #4-4
SCALE QA SHEET

Scale Mettler
Model AE100
SN K04827

Level	Recali-brated	100g Weight	10g Weight	1.0g Weight	100mg Weight	20mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	Yes	99.9998	10.0000	1.0001	.1001	.0201	9/17/99	2045	ATM	66	79	49
✓	Yes	99.9997	10.0000	1.0000	.1001	.0200	9/18/99	1217	ATM	65	78	48
✓	No	99.9996	10.0000	1.0000	.1000	.0200	9/19/99	1245	ATM	62	75	49
✓	Yes	99.9998	10.0001	1.0001	.1001	.0201	9/23/99	2028	ATM	65	79	47
✓	Yes	99.9997	10.0000	1.0000	.1000	.0201	9/24/99	1145	ATM	64	77	49
✓	Yes	99.9997	10.0001	1.0001	.1001	.0200	9/27/99	2000	ATM	59	89	48
✓	No	99.9997	10.0000	1.0000	.1000	.0200	9/28/99	1340	ATM	58	70	48

Unit: Kuma Wood Classic
Run: EPA 6
Date: 9/17/99
Technicians: ATM
WST20,Form5

Woodstove Particulate Catch Processing Sheet
Woodstove Data Sheet #5
EPA M5G-1

Filters

Filter #	(F) 940	Beaker #	23	Final Wt.	70.7476 g
Final Wt	.8251 g	Ml	37	Tare Wt.	70.7375 g
Tare Wt	.8151 g	Desc.	Acetone	Net Wt.	.0101 g
Net Wt	.0100 g				

Filter #	(R) 939	Beaker #		Final Wt.	g
Final Wt	.8009 g	Ml		Tare Wt.	g
Tare Wt	.8058 g	Desc.		Net Wt.	g
Net Wt	-.0049 g				

Acetone Blank Calculation: Blank done 7/18/99

Blank Beaker #	1	Final Wt	65.4847
Ml	50	Tare Wt	65.4847
Desc	Acetone	Net Wt	.0000

.0000 g : 50 ml = .0000 g/ml

Particulate Catch Calculation

Filter: .0100 g

Filter: -.0049 g

Beakers: .0101 (Total Catch) - (37)(.0000) (Ml of Acetone Blank Value/Ml of Acetone) = .0101 g

Total Catch = .0152 g

Unit Kuma Model Classic
Run # EPA 6
Date 9/17/ 1999
Technician ATM RAS J.P.
WST6-Form1, Rev8/96

MISCELLANEOUS TEST DATA
WOODSTOVE DATA SHEET #8

Useable Firebox Dimensions: See QC Section Useable Volume: 2.228 ft^3

Dilution Tunnel Draft (If applicable): Start 00.0 Stop 00.0

Test Chamber Air Velocity: Start: 00.0 Stop: 00.0 Avg: 00.0

Wet Bulb/ Start: WB: 65 °F DB: 74 °F 1.8 % Amb Moisture 61 %RH

Dry Bulb Stop: WB: 65 °F DB: 77 °F 1.65 % Amb Moisture 52 %RH

$\bar{X}$ = 1.725 % Ambient Moisture $\bar{X}$ = 56.5 % Relative Humidity (RH)

Empty Stove Wt: 419.3 lbs.

Empty Stove Wt with Stack (Inc. Oil Seal) Wet: 510.8 lbs. Dry: 509.9 lbs.

Empty Stove Wt with Stack and Ash Ash: — lbs. Total: — lbs.

Kindling Wt. Paper: 0.7 lbs. Wood: 5.6 lbs.

Pre Burn Fuel Wt. 15.2 + 15.5 + 16.4 Total: 47.1 lbs.

Total Kindling and Pre Burn Fuel Wt 53.4 lbs.

Coal Bed Wt-lbs: Range (613.5 - 612.9) 3.6 - 3.0 lbs. Actual: 3.0 lbs.

Allowable Amount of Charcoal that can be removed:

Coal Bed Wt. Range $\frac{3.6}{\text{Upper Wt.}} + \frac{3.0}{\text{Lower Wt.}}$ /2 X .25 = .8 lbs.

Test Fuel Wt-lbs: Ideal 15.6 lbs. Range: 17.1 - 14.1 lbs. Actual: 14.7 lbs.

Test Fuel Size (pcs.) (.75 x 1.5 x 5" Flanges) 16 Pcs.

2 x 4's x 15 9/16	"	3 Pcs	6.3 lbs.	42.9 %
4 x 4's x 15 9/16	"	2 Pcs	8.4 lbs.	57.1 %

Est. Dry Burn Rate (Kg/Hr.) $\frac{14.7 - (14.7 \times .17790)}{2.2046} \times \frac{60}{109} = 3.0174$ Est. Dry Burn Rate (Kg/Hr)

Est EPA Heat Output (HO_E) (Avg BTU's/Hr) (19,140) X $\frac{63}{100}$ x 3.0174 = 36,385 Est Heat Output (HO_E) BTU's/Hr

Comments:

Stove Operating Data
Woodstove Test Data Sheet #9
Cold Start - High Burn

Unit: Kuma Wood Classic
Run: EPA 6
Date: 9/17/94
Technician(s): [illegible]
Data Sheet #9 - Rev 1/98-Pg.5

Fire Started: 0547 P.D.T.

Warm up and Preburn: Primary Air: Wide open from ignition until the start of the test. At the run setting of wide open until the start of the test. High burn.

Secondary Air: No Controls. Naturally drafted.

Secondary Burn/Cat Bypass: N/A

Charcoal Bed Preparation: Broke up, raked and leveled the coal bed prior to the addition of each warm up/pre burn fuel charge. Starting 1'30 before the start of the test, broke up, raked and leveled the coal bed. In stove for 35 seconds.

Test: Door wide open during loading _____ min 54 sec, then closed.

Primary Air: Wide open from the start of the test (0:00) until the end of the test. High Burn.

Secondary Air: No Controls, Naturally drafted

Secondary Burn/Cat Bypass: N/A

Fan: ON/OFF during the warm up, ON/OFF high during the preburn, ON/OFF at the start of the test, ON/OFF for the first 1:00 minutes of the test, ON/OFF high at 1:00 minutes into the test, ON/OFF for the rest of the test.

Test Run Anomalies:

Burn Rate was slower than expected.

Unit Kuma Napoleon Classic
Run # EPA 6
Date 9/17/ 1999
Technician ATM RLS JP
Page 1 of 3
WST7-Form2-A, Rev10/88

WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-1

Wood Data: Kindling: A mix of the below grades

	Size	Mill	Grade	Species
Pre Burn	2X4	Canyon Lumber	#2 & Better	D. Fir SFC Grn
Test Fuel	2X4	Canyon Lumber	#2 & Better	D. Fir SFC Grn
	4X4	R.I.B. Const.	#1	D. Fir SFC Grn

All grades WCLB Rules unless otherwise noted.

Warm up Information:

1st Warm up/Pre Burn Fuel charge (15.2 lbs) added at 0616.
2nd Warm up/Pre Burn Fuel charge (15.5 lbs) added at 0715.
3rd Warm up/Pre Burn Fuel charge (16.4 lbs) added at 0815.
4th Warm up/Pre Burn Fuel charge (_____ lbs) added at _____.
5th Warm up/Pre Burn Fuel charge (_____ lbs) added at _____.
6th Warm up/Pre Burn Fuel charge (_____ lbs) added at _____.
7th Warm up/Pre Burn Fuel charge (_____ lbs) added at _____.
8th Warm up/Pre Burn Fuel charge (_____ lbs) added at _____.

The coals were scooped out of the stove immediately prior to adding the 3 (ED) pre burn/warm up fuel charge. The stove lost 9 lbs. 3.5 lbs. of coals were put back in the stove after the scoop.

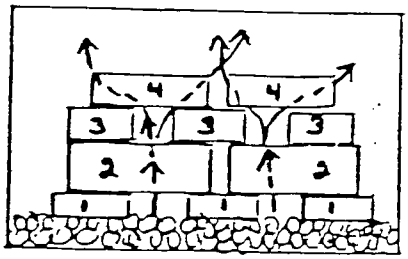
All pre burn/warm up fuel pieces were [redacted] _____ [redacted] 16" inches long. All preburn pieces/fuel charges were "ricked" in the stove. The pieces in the bottom layer in each rick contained 2 pcs that were 16 inches long and were loaded flat and perpendicular to the door. The pieces in the second layer in each rick were loaded on their side (edge) approximately parallel to the door and contained 4 pcs 16 inches long. The third layer (and fourth layer if present) was loaded flat, perpendicular to the door and contained 3 pcs 16 inches long. The majority of the pieces in each rick were in the second layer which had an approximate 0.5-1.0" space between pieces. (The loading directions indicate the direction of the longest dimension on each piece relative to the loading door opening.) Each pre burn/warm up fuel charge normally weighs within the weight range allowed for the actual test fuel charge

Unit Kuma Wood Classic
Run # EPA 6
Date 9/17/1999
Technician AJM RLS JP
Page 2 of 3
WST7-Form2-A, Rev 6/90

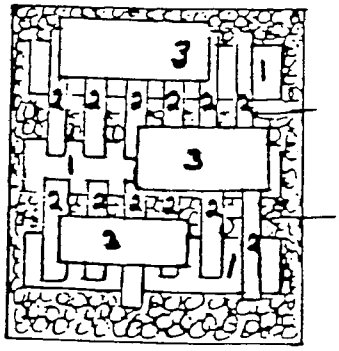
WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-2

Warm up Information (cont.):

Each warm up/preburn fuel charge was ricked in exactly (as much as possible) the same manner and the weight of each rick was usually within the allowable weight range for the test fuel charge. The physical arrangement and alignment of each rick was designed to accomplish three (3) things: (1)The bottom layer was nestled firmly into the coal bed and was as close to being level with the bottom of the stove as possible, thus providing a stable loading platform for the rest of the rick, keeping it in a ricked state (as opposed to a col- lapsed or fallen down state) untill the rick reached the charcoal stage and sags or collapses of its own accord. (2) It enhances the flow of primary air through the ricked preburn fuel charge, for the primary air would flow through the spaces between the pieces in the first layer and then up through the spaces between the pieces in the second, third and, if present, fourth layers. (3) It maximized, as much as possible, the surface to volume ratio of each preburn fuel charge, thereby allowing the fire immediate access to as much wood surface as possible and, thereby, insuring uniform charcoalization. All three of these enhance combustion and so get the stove as hot as possible during the warm up period, therby maximizing the amount of heat (BTU's) stored in the stove. The actual preburn was not started until the stove surface temperatures had maximized and stabilized, thus indicating that the amount of heat stored in the stove had peaked. For this stove, the thermal storage was monitored using the Top surface temperature(s) and the peak value(s) obtained were 950 °F.



Front View



Top View

The arrows indicate the direction of the air flow through the rick.

The primary air was adjusted to the run setting of Wide Open 53.4 lbs above the upper charcoal bed weight.

Unit Kuma Wood Classic
Run # EPA 6
Date 9/17/99
Technician AM
Page 3 of 3
WST5-Form2-Rev11/89

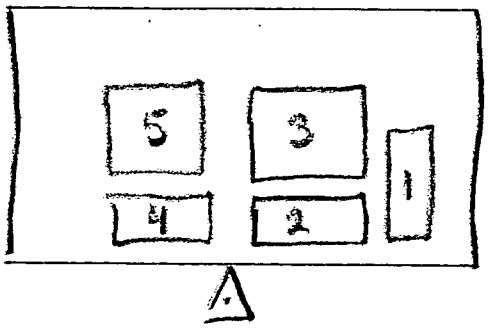
WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-3

Additional Comments: Test Start Sequence: ① Turned Fan off ② Opened Door ③ Loaded test fuel charge ④ Cleared coals away from LPHO ⑤ Probe ⑥ closed door

Total Elapsed Time: 0:54

Test Fuel Charge Loading Information:

Test Fuel Charge and Loading Sequence Diagram



Front of stove view

4 X 4's: 3 & 5

2 X 4's: 1, 2 & 4

Loading Sequence: 1, 2, 3, 4 AND then 5

Driest Pcs in Load 2 & 4, 3

Loaded the test fuel charge on an essentially level, Medium sized, hot coal bed (in appearance, color and temperature for a high burn rate. LPHO 0:54 Ignition 0:33

0:50 VC to baffle Fan ON High @ 9:00.
1:30 Flames / 2nds forward past front tube.
1:40 Front Tube igniting. Firebox engulfed in flames.
2:58 .17 / 14.1
6:00 16.4% CO_2 / .35% CO
7:00 16.4 / .37
8:00 16.2 / .45
9:00 16.0 / .55
10:00 16.0 / .61
11:00 15.9 / .58
26:55 L. Stack ↓
29:00 15.7 / .42
12:00 15.7 / .55
13:00 16.0 / .58
14:00 16.0 / .41
17:00 16.0 / .77
18:00 15.9 / .86 CO Peak
19:00 15.9 / .94 0.95%
23:00 14.2 / .22

Unit: Kuma Mod Cubic
Run: EPA 6
Date: 9/17/ 1999
Technician: AJM WLS JAP
WST1-Form7-Rev11/89

FUEL MOISTURE
WOODSTOVE TEST DATA SHEET #10

Room Temperature: 62 °F

Correction Factor: + 1

NOTE: Record readings to the nearest 0.5% moisture
Uncor Values are corrected for temperature: Yes ✓. No ____
Time Test Fuel Moisture Readings taken at: 0750
Calibration Checks: X — Y — 12.5 12.0 22.0 22.6

Pc #	Dimen	Use	Top		Bottom		Side		Piece Avg Corrected
			Uncor	Cor	Uncor	Cor	Uncor	Cor	
1	2x4x8'	K	11.5	12.3	11.0	11.7	11.0	11.7	11.900
2									
3									
4	2x4x8'	P	18.5	19.8	19.5	20.9	20.5	22.0	20.900
5	"	|	18.5	19.8	13.5	19.8	18.0	19.2	19.600
6	"	|	19.5	20.9	19.5	20.9	20.0	21.4	21.067
7	"	↓	18.5	19.8	20.5	22.0	23.0	24.9	22.233
8									83.800
9									
10	2X4-15 9/16"	T	18.0	19.2	18.5	19.8	18.0	19.2	19.400
11	"	|	21.0	22.6	20.5	22.0	19.5	20.9	21.833
12	"	↓	23.0	24.9	21.5	23.1	21.5	23.1	23.700
13									
14	4X4-15 9/16"	T	18.0	19.2	19.5	22.1	20.0	21.4	20.500
15	"	↓	21.0	22.6	21.0	22.6	21.5	23.1	22.767
16									108.200
17									
18									
19	5X1.5X.75	Spacers	20.5	22.0	20.0	21.4	20.0	21.4	21.600
20									OUT-Spacers

	Kindling	Pretest Fuel	Test Load
% Moisture - Dry Basis:	11.908 %	20.950 %	21.640 %
% Moisture - Wet Basis:	10.634 %	17.321 %	17.790 %

To obtain Wet from Dry: $\frac{100 \times \%\ \text{Dry Rdg.}}{100 + \%\ \text{Dry Rdg.}}$ = % Moisture, Wet Basis

Acceptable Ranges: 16-20% wet; 19-25% dry
(17.5 - 22.5 on Meter [Uncor reading] at 70°F)

Key for Use: K= Kindling P= Pretest Fuel T= Test Fuel

Unit: Kuma Wood Classic
Run#: EPA 6
Date: 9/17/1999
Technician: ATTN RLS

WOOD DENSITY DETERMINATION
WOODSTOVE TEST DATA SHEET #11

WST2-form11-Rev 6/90

Wood Piece: Nominal Dimensions: 3½" x 3½" x 1½" in

Depth (D): in 1.523 cm 3.868 ✓

Width (W): in 3.548 cm 9.012 ✓

Length (L): 3.248 in
3.240 in
3.244 in
3.220 in

Length $\bar{X}$ = in 3.238 ✓ cm 8.225 ✓

Volume: 286.710 cm^3 ✓
(D X W X L)

MOISTURE: Room Temperature: 69 °F Correction Factor: 0

Uncorrected Meter Readings Corrected for temperature: Yes ✓ No ___

NOTE: Record moisture meter readings to the nearest 0.5%

	Uncor	Cor
Top:	23.0	24.9 %
Bottom:	22.5	24.3 %
Side:	21.5	23.1 %
$\bar{X}$:		24.100 % ✓

Avg % Moisture (Dry) 24.100 % ✓

Aug % Moisture (Wet) 19.420 % ✓

Scale: Leveled In ✓ Out ✓
Zeroed: In ✓ Out ✓

Wet Weight: 178.5 g Dry Weight: 150.7 g

% Moisture Dried Basis: 15.574 % ✓
[1 - (Dry Wt ÷ Wet Wt)] X 100

	Date	Time	Temp
Into Dryer	9/17/99	0800	213 °F
Out of Dryer	9/22/99	1550	214 °F

(Minimum Time in Dryer: 24 hrs.) Minimum Dryer Temp 100°C (212°F)

Density = 150.7 g (dry wt) ÷ 286.710 cm^3 (volume) = 0.5256 g/cm^3 ✓

Pellet Fuel Moisture Content Determination

Tare Beaker Wt. _____ g

Wet Wt: _____ g - _____ g = _____ g
Gross Wet Wt. Tare Beaker Wt. Net Wet Wt.

Dry Wt: _____ g - _____ g = _____ g
Gross Dry Wt. Tare Beaker Wt. Net Dry Wt.

% Moisture Dried Basis: _____ %
[1 - (Net Dry Wt ÷ Net Wet Wt.)] X 100

BURN RATE AND FLUE GAS DATA
WO(TOVE DATA SHEET #12
WS(Form 14 Rev 1/88

Unit: Ikuma Wood Classic Date: 9/17/19
Run: EPA 6
Page: 1 of 1
Technician(s): AK, MS, TR

END Wt: 512.9 lbs.

Minute / Time	Scale Wt	lbs left	Burn Rate	CO2 v.	CO2 %CO2	O2 v.	O2 %O2	Tel	CO v.	CO %CO	Bal	Wet Bulb	Dry Bulb	% H2O	Calc W/B	Stack	SO2 v.	SO2 PPM	Static Press.	Comments
0 / 0946	527.6	14.7	O	.324	8.03	48.8	12.19	GAS BAL.	5.8	0.30	76.8	85	139	2.2	126	478			-.070	Flow
5 / 4	521.6	13.7	1.0	.628	15.53	17.6	4.40		4.6	0.24	64.7	102	150	5.2	140	635			-.087	SO2 1.5
10 / 9	525.1	12.2	1.5	.644	15.92	17.6	4.40		9.0	0.46	34.6	126	162	12	151	679			-.090	CO2 1.5
15 / 14	523.8	10.9	1.3	.634	15.67	17.9	4.47		10.4	0.53	29.6	132	169	16	156	687			-.091	O2 1.5
20 / 19	522.4	9.5	1.4	.635	15.70	17.7	4.42		17.0	0.86	18.3	133	171	16.5	157	696			-.091	CO 1.5
25 / 24	521.1	8.2	1.3	.648	16.02	16.9	4.23		4.3	0.22	72.8	131	170	15	155	695			-.091	
30 / 29	519.7	7.0	1.2	.617	15.26	18.6	4.65		3.3	0.18	84.8	130	170	14	154	680			-.090	
35 / 34	518.5	5.9	1.1	.637	15.75	17.7	4.42		6.1	0.31	60.8	128	171	12.5	152	685			-.090	
40 / 39	517.8	4.9	1.0	.591	14.61	22.6	5.65		1.4	0.08	182.7	124	168	12	151	654			-.087	
45 / 44	516.9	4.0	.9	.568	14.05	24.5	6.12		1.1	0.07	200.7	122	163	11	149	640			-.086	
50 / 49	516.2	3.3	.7	.512	12.67	29.7	7.42		1.0	0.06	211.1	119	160	9.5	145	613			-.083	
55 / 54	515.6	2.7	.6	.441	10.92	36.2	9.04		1.0	0.06	181.9	114	155	9.3	143	580			-.080	
																(7716)			(1.436)	Flow
60 / 59	515.1	2.2	.5	.393	9.73	41.1	10.27		1.9	0.11	88.5	108	149	7.0	138	543			-.076	SO2 1.5
65 / 64	514.6	1.7	.5	.377	9.34	43.2	10.79		2.0	0.11	84.9	104	145	5.8	134	527			-.075	CO2 1.5
70 / 69	514.3	1.4	.3	.341	8.45	46.5	11.62		2.7	0.15	66.3	99	140	4.9	132	507			-.072	O2 1.5
75 / 74	514.1	1.2	.2	.258	6.41	54.6	13.64		4.9	0.25	25.6	95	135	4.2	130	475			-.068	CO 1.5
80 / 79	513.9	1.0	.2	.252	6.26	55.1	13.76		7.1	0.37	16.9	90	132	3.5	127	459			-.067	
85 / 84	513.7	.8	.2	.252	6.26	55.4	13.84		8.7	0.45	13.9	87	130	2.9	124	449			-.066	
90 / 89	513.6	.7	.1	.234	5.81	57.6	14.39		9.7	0.50	11.6	85	128	2.6	123	440			-.065	
95 / 94	513.4	.5	.2	.214	5.32	59.5	14.86	OUT BAL.	12.9	0.65	8.2	84	126	2.4	121	426			-.063	
100 / 99	513.2	.3	.2	.203	5.05	60.3	15.06		14.4	0.72	7.0	83	124	2.3	121	416			-.062	
105 / 104	513.1	.2	.1	.202	5.02	60.1	15.01		14.6	0.74	6.8	82	122	2.3	120	408			-.062	
~~110~~ / 109	512.9	0	.2	.205	5.10	60.0	14.99		13.7	0.69	7.4	82	122	2.3	120	405			-.061	
115 / 114																(3055)			(.737)	
	109 minutes													23÷		(12.25)			(1.773)	
																556			(.134)	

Pre Burn Stack Wt. ____ lbs. Vp ____ lbs.
Test Stack wt. Range 513.5 - 512.9 lbs.

PRE BURN DATA RECORD SHEET #13
WST2-Form16

BARO. PRESSURE 28.65 "Hg

Unit: Kuma Wood Chunk Date: 9/17/1991
Run: EPA 6e Technician(s): AT/TJ KH
Page: 1 of 1 J.P.

Real Time #17

Minute Time	Scale Weight	Burn Rate	Stack	Stove Top	Left Side	Back	Right Side	Bottom	Firebox	2nd Burn ~~Catalytic~~	Room Temp	Static	Comments
0 0815	529.4	0	439	501	670	412	662	579	841	1228	67	-.080	Primary Air Set at WIDE
5 20	527.6	1.8	641	747	648	426	636	576	805	1402	69	-.091	Secondary Air Set at N/A
10 25	525.2	2.4	669	815	623	397	611	572	814	1512	69	-.092	Fan: ON HIGH
15 30	522.8	2.4	686	908	617	386	607	502	837	1626	69	-.071	TUNNEL ON AT: 0830
20 35	520.8	2.0	710	910	624	378	618	489	922	1722	69	-.092	Buckets IN D
25 40	518.8	2.0	699	907	646	379	639	486	1011	1795	69	-.090	ANALYZERS SPANNED
30 45	517.0	1.8	700	905	675	377	668	483	1114	1770	70	-.096	Pumps turned on at: 0860
35 50	515.9	1.1	665	885	705	375	701	478	1149	1668	70	-.085	ΔT
40 55	515.3	.7	564	734	733	386	736	469	1164	1405	69	-.078	RATE 610.4
45 0900	514.9	.3	584	734	736	380	736	468	1024	1492	70	-.078	Check WB/DB: 86/101 610.8
50 05	514.6	.3	573	720	729	373	725	461	1057	1593	68	-.077	601.6
55 10	514.3	.3	541	664	715	364	712	454	1042	1365	69	-.075	581.8
													Probe IN TUNNEL
60 15	514.0	.3	523	620	700	359	695	448	1026	1319	67	-.075	
65 20	513.8	.2	517	600	686	355	682	449	1013	1253	67	-.073	554.4
70 25	513.5	.3	571	585	677	350	670	453	999	1227	66	-.073	547.0
75 30	513.3	.2	496	573	669	348	661	456	989	1245	66	-.071	541.4
80 35	513.1	.2	484	550	662	344	652	458	961	1204	66	-.071	
85 40	512.9	.2	478	537	655	340	643	455	950	1210	66	-.070	576.0
90 45													

TEMPERATURES
RECORD SHEET #14
WST2-Form14 Rev7/96

Unit: Kuum Wood Chunk Date: 9/17/ 19
Run: EPA 6
Page: 1 of 1
Technician(s): ATM J.P. DLS
Rerun 2nd

T/C#	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Minute / Time	Stove Top	Left Side	Back	Right Side	Bottom	Firebox	2nd Burn [redacted]	Room Temp	Tunnel	C. Gas Box	Impinger Out	5G-1 Filter	5G-1 Condenser	[redacted]	HOT BOX
0 0940	537	655	340	643	455	950	1210	66	121	249	37	78	56	1061	250
5 45	593	640	345	627	458	906	1197	67	139	250	38	79	35	1215	250
10 50	797	635	335	608	454	972	1596	67	149	250	39	82	35	1370	250
15 55	839	644	332	606	458	976	1596	68	153	250	39	85	35	1376	250
20 1000	[illegible]	655	332	611	450	1022	1521	67	154	250	39	86	[illegible]	1322	250
25 05	857	667	335	618	448	1084	1416	68	155	249	39	87	35	1436	250
30 10	849	684	340	628	446	1093	1394	69	154	248	39	88	35	1463	250
35 15	856	696	352	637	444	1104	1368	69	153	250	39	88	35	1496	250
40 20	876	706	368	650	440	1121	1363	69	150	250	40	88	35	1413	250
45 25	808	715	383	658	439	1135	1357	69	148	250	39	88	35	1338	250
50 30	710	720	387	670	441	1139	1329	69	144	250	38	87	35	1321	250
55 35	726	720	387	684	441	1126	1300	69	139	249	38	87	35	1336	249
	9324	8137	4236	7640	5374	12,628	16,647	817							
60 40	662	715	397	689	442	1132	1264	69	135	248	38	86	35	1321	248
65 45	628	710	408	693	441	1127	1230	70	131	248	38	85	35	1321	248
70 50	595	703	421	690	442	1110	1241	69	128	249	38	84	36	1297	249
75 55	556	694	427	682	448	1073	1159	69	124	249	38	84	36	1272	249
80 1100	522	681	422	667	452	1050	1114	69	122	250	38	83	35	1177	250
85 05	502	667	413	654	460	1012	1105	70	120	249	38	81	35	1119	250
90 10	486	654	403	642	463	984	1080	70	119	249	38	80	36	1061	250
95 15	471	640	390	629	466	957	1051	70	117	249	38	79	36	1024	250
100 20	456	627	377	616	467	939	1026	70	116	249	38	79	36	1011	250
105 25	442	612	366	603	465	919	1004	71	115	248	39	79	36	999	250
110 30	438	605	361	597	465	914	1008	71	114	249	39	79	36	991	250
116 35	5763	7308	4385	7162	5016	11,217	12,272	768							
	15,241	15,445	8621	14,802	10,390	23,845	28,919	1585	23	AVG. STOVE ET. CHANGE			STRT	526.0	✓
	655	613	375	644	452	1037	1257	69					STOP	493.2	✓
													ΔT	-32.8	✓

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-1

Site: Myren Consulting, Woodinville, WA Date: 9/17/99 Analyte: CO_2

Source: Kuna Wood Classic Run #: EPA 6

Zero Cyl #: 719 430 Conc. 00.0 % CO_2 Cyl Press: 1830 psi

Certified by: Oxarc Date: 4/1/99

Span Cyl #: 350-794 Conc. 12.5 % CO_2 Cyl Press: 1310 psi

Certified by: Oxarc Date: 3/26/99

Analyzer: Make: Horiba Model: PIR-2000 SN: 607024

Range: 0 - 25.0% CO_2 Analyzer Output: 0 - 1.0 v.

Flow: 1.5 SCFH Measured by: Rotameter: X Flowmeter:

EPA Span Value = 25.0% CO_2

EPA Control Limits = ± 2.5% of 25.0% CO_2 = ± 0.625% CO_2

Pre Run Audit: By: RLS Time: 0845 Temp: 70 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	.000	00.0	00.0	.000	.04457	+.0446	+0.18
Span	50.0	.500	12.5	49.5	.494	12.2232	-.2768	-2.21

Comments:

Post Run Audit: By: RLS Time: 1135 Temp: 71 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	.000	00.0	00.0	.000	.00457	+.0446	+0.18
Span	50.0	.500	12.5	49.5	.493	12.1986	-.3014	-2.41

Comments:

± Conc. Difference = Act % - Exp (Std) %

Zero % Differece = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}} \times 100$

Span % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Exp \% (ppm)}} \times 100$

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-2

Site: Myren Consulting, Woodinville, WA Date: 9/17/99 Analyte: O_2

Source: [illegible] Run #: EPA 6

Zero Cyl #: 719 430 Conc. 00.0 % O_2 Cyl Press: 1830 psi

Certified by: Oxarc Date: 4/1/99

Span Cyl #: 250-794 Conc. 12.5 % O_2 Cyl Press: 1310 psi

Certified by: Oxarc Date: 3/26/99

Analyzer: Make: Taylor Model: OA 137 SN: 137/4772

Range: 0 - 25.0% O_2 Analyzer Output: 0 - 100 mv.

Flow: 1.5 SCFH Measured by: Rotameter: X Flowmeter:

EPA Span Value = 25.0% O_2

EPA Control Limits = + 2.5% of 25.0% O_2 = + 0.625% O_2

Pre Run Audit: By: RLS Time: 0845 Temp: 70 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	00.1	00.0	.0050	+.0050	+0.02
Span	12.5	50.0	12.5	12.5	49.6	12.3909	-.1091	-0.87

Comments:

Post Run Audit: By: RLS Time: 1135 Temp.: 71 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	00.1	00.0	.0050	+.0050	+0.02
Span	12.5	50.0	12.5	12.5	49.6	12.3909	-.1091	-0.87

Comments:

± Conc. Difference = Act % - Exp (Std) %

Zero % Differece = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}} \times 100$

Span % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Exp \% (ppm)}} \times 100$

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-3

Site: Myren Consulting, Woodinville, WA Date: 7/17/99 Analyte: CO

Source: Kuma Wood Stoves Run #: EPA 6

Zero Cyl #: 719 430 Conc. 00.0 % CO Cyl Press: 1830 psi

Certified by: Oxarc Date: 4/1/99

Span Cyl #: 250-794 Conc. 2.5 % CO Cyl Press: 1310 psi

Certified by: Oxarc Date: 3/26/99

Analyzer: Make: Infra Red Model: 702 D SN: 113

Range: 0 - 10.0% CO Analyzer Output: 0 - 100 mv.

Flow: 1.5 SCFH Measured by: Rotameter: X Flowmeter:

EPA Span Value = 5.0% CO
EPA Control Limits = +2.5% of 5.0% CO = + 0.125% CO

Pre Run Audit: By: RLS Time: 0845 Temp: 70 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	0.00	00.0	-.0093	-.0093	-0.19
Span	2.50	50.0	2.50	2.50	50.0	2.4914	-.0086	-0.34

Comments:

Post Run Audit: By: RLS Time: 1135 Temp.: 71 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	0.00	00.1	-.0093	-.0093	-0.19
Span	2.50	50.0	2.50	2.48	49.4	2.4614	-.0386	-1.54

Comments:

± Conc. Difference = Act % - Exp (Std) %

Zero % Differece = $\frac{\text{Act \% (ppm)} - \text{Exp \% (ppm)}}{\text{Full Scale Value}} \times 100$

Span % Difference = $\frac{\text{Act \% (ppm)} - \text{Exp \% (ppm)}}{\text{Exp \% (ppm)}} \times 100$

Unit: Kuma Wood Check
Run: EPA 6
Date: 9/17/99
Technicians: ATM / RLS, T.P.
WST6-Form3-Rev11/89

QUALITY CHECKS
WOODSTOVE DATA SHEET #16

Ambient = Tr: _____ °F T/C#30: _____ °F

Thermocouple Check (at ambient): T/C#1: 62 °F; T/C#2: 62 °F;

T/C #3: 66 °F;	T/C #4: 66 °F;	T/C #5: 69 °F;
T/C #6: 66 °F;	T/C #7: 68 °F;	T/C #8: 69 °F;
T/C #9: 70 °F;	T/C #10: 73 °F;	T/C #11: 62 °F;
T/C #12: 62 °F;	T/C #13: 64 °F;	T/C #14: 63 °F;
T/C #15: 64 °F;	T/C #16: 62 °F;	T/C #17: 70 °F;
T/C #18: 63 °F;	T/C #19: _____ °F;	T/C #20: _____ °F;
T/C #21: _____ °F;	T/C #22: _____ °F;	T/C #23: _____ °F;
T/C #24: _____ °F;	T/C #25: _____ °F;	T/C #26: _____ °F;

Comments: _____

Thermocouple Readout: Pretest Zero/Span Check and Calibration:

Zero (0°F): 001 °F	Adj to: — °F	Post Test Check Zero (0°F): 001 °F	% Difference +0.05 %
Span (2000°F): 1999 °F	Adj to: — °F	Span (2000°F): 2000 °F	0 %

(Allowable % Difference = 1.5%. Use formulas on Woodstove Data Sheet #15 to calculate % Difference)

Thermocouple Readout Pretest Linearity Check

0°F = 001 °F;	200°F = 201 °F;	400°F = 399 °F;
600°F = 600 °F;	800°F = 800 °F;	1000°F = 1002 °F;
1200°F = 1200 °F;	1400°F = 1400 °F;	1600°F = 1600 °F
1800°F = 1799 °F;	2000°F = 1999 °F	

Combustion Gas (CO_2,O_2,CO) Train Leak Check: Pre ✓ Post ✓

Draft (Static) Guage Zero Check: Pre ✓ Post ✓

Scale Check Pre (Wt, #'s): 516.9 - 511.9 = 5.0/5.0 = OK ATM

Post (Wt, #'s): 512.8 - 517.8 5.0 lbs. OK (RLS)

Stack cleaned prior to the run: Yes _____ No ✓

Tunnel cleaned prior to the run: Yes _____ No ✓

DILUTION TUNNEL CALCULATIONS

MYREN CONSULTING CERTIFICATION TEST DATA

3/31/96

File Name:	KuamEPA7
Stove Manufacturer:	Kuma
Model Number:	Wood Classic
Lab Name:	MYREN
Test Date:	9\18\99
Run Number:	EPA 7
Meter Box Y Factor:	1.0151
Barometric pressure (in):	28.613
Gas meter temp (ave):	86
delta H(avg):	0.900
Gas meter initial reading:	202.100
Gas meter final reading:	247.799
Front catch (acetone) mg:	10.8
first filter catch (mg):	38.6
second filter catch (mg):	0.2
tunnel flow (ave cfm):	142.798
Emission Rate(g/hr):	10.027
Emission Rate(M5H) :	12.332
vs/VmTs:	0.0349
vs ave:	905.736
Tunnel average temp (°f):	143.300
Test time(min):	82
Fuel Load(lb. wet):	14.6
Wood moisture(%wet):	17.831
Burn rate(dry kg/hr):	3.982
Samp vol(scf):	42.994
front filter number	942
back filter number	941
acetone beaker number	27
PRELIMINARY RESULTS	
FINAL RESULTS	AUDITED
DATA SUMMARY	
MODEL :	Wood Classic
RUN:	EPA 7
DATE:	9\18\99
DBR:	3.982
GPH UNADJ	10.027
ADJ	12.33243514

RUN TIME (min)	PITOT DELTAP (- INCH H20)	TNL TEMP (°F)	GAS METER RDG (ft3)	GAS METER TEMP (°F)	GAS METER DELTA H (in.H2O)	TUNNEL VELOCIT (ft/min)	PROP RATE (%)	dDGM vol std (ft3)
0	0.044	125	202.100	79	0.900	901.25		
10	0.043	162	207.638	80	0.900	918.69	104.1	5.267
20	0.043	166	213.185	82	0.900	921.64	102.5	5.256
30	0.043	160	218.741	84	0.900	917.21	101.0	5.245
40	0.043	154	224.295	86	0.900	912.77	100.1	5.224
50	0.043	143	229.862	87	0.900	904.55	98.9	5.226
60	0.043	138	235.438	88	0.900	900.79	98.9	5.225
70	0.043	131	241.045	89	0.900	895.51	98.5	5.245
80	0.043	127	246.673	90	0.900	892.47	98.6	5.255
82	0.043	127	247.799	90	0.900	892.47	99.0	1.051
						0.00	0.0	0.000
110						0.00	0.0	0.000
120						0.00	0.0	0.000
130						0.00	0.0	0.000
140						0.00	0.0	0.000
150						0.00	0.0	0.000
160						0.00	0.0	0.000
170						0.00	0.0	0.000
180						0.00	0.0	0.000
190						0.00	0.0	0.000
200						0.00	0.0	0.000
210						0.00	0.0	0.000
220						0.00	0.0	0.000
230						0.00	0.0	0.000
240						0.00	0.0	0.000
250						0.00	0.0	0.000
260						0.00	0.0	0.000
270						0.00	0.0	0.000
280						0.00	0.0	0.000
290						0.00	0.0	0.000
300						0.00	0.0	0.000
310						0.00	0.0	0.000
320						0.00	0.0	0.000
330						0.00	0.0	0.000
340						0.00	0.0	0.000
350						0.00	0.0	0.000

METHOD 5G-1 PARTICULATE SAMPLING DATA Kuma LAB-

DATE 9/18/99 PAGE 1 OF 1 MODEL # Wood Classic RUN # EPA 7

METER BOX # 511-M METER Y 1.0151 FILTER # (F) 942 (R) 941

PRE TEST LEAK RATE = .0005 CFM @ -15.5 IN. HG .823/.803 FILTER SIZE: 110 mm

POST TEST LEAK RATE = .000 CFM @ -12.5 IN. HG .834/.834 PROBE LENGTH 24" abs

TIME		METER READING CU.FT.	PITOT dp	TNL TEMP. (°F)	METER TEMP. (°F)	GAS METER dh	VAC IN. Hg
CLOCK	ELAPSED						
9:50	00	202.100	.044	125	79	.90	0
10:00	10	207.638	.043	162	80	.90	0
10	20	213.185	.043	166	82	.90	0
20	30	218.741	.043	160	84	.90	0
30	40	224.295	.043	154	86	.90	0
40	50	229.862	.043	143	87	.90	0
50	60	235.438	.043	138	88	.90	0
11:00	70	241.045	.043	131	89	.90	0
10	80	246.673	.043	127	90	.90	0
12	82	247.799	.043	127	90	.90	0
	00						
	10						
	20						
	30						
	40						
	50						
	60						
	70						
	80						
	90						

VELOCITY TRAVERSE

POINT	LOCATION	ΔP	TEMP
N-1	0.5"	.043	137
2	1.5"	.047	139
3	4.5"	.046	140
4	5.5"	.040	139
W-1	0.5"	.041	136
2	1.5"	.046	138
3	4.5"	.046	139
4	5.5"	.044	140
	Avg.	.0445	138.5 ~~98.5~~

Pilot Leak Check Pre ✓ Post ✓

Cp = 0.99

N
1
2
→ W 1 2 3* 4
3
4

*=point of Avg. delta p

$$Qs = \left(\frac{\sqrt{(\Delta P \times BP)}}{T(°R)}\right) \times 3167.2 =$$

146.154 cfm

BP = Stn 28.64 in Hg
60 28.62
82 28.59

$\bar{X}$ = 28.613

WOODSTOVE DATA SHEET #4-1: INITIAL FILTER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date 1/9/99 Time 1445 By ATM Front Half ✓ Back Half ✓

Manufacturer: Schleicher & Schuell Size: 11cm Lot No.: Z8961 Grade: #25 Glass
Order No: 06220

Filter #	First Wt	Date	Time	By	Second Wt	Date	Time	By	Third Wt	Date	Time	By
926	.7740	3/6/99	1140	T.M.	.7739	3/15/99	1652	ATM				
927	.7938		1141	T.M.	.7938		1651	ATM				
928	.7985		1142	T.M.	.7985		1650	ATM				
929	.7909		1143	T.M.	.7912		1649	ATM				
930	.7948		1144	T.M.	.7950		1648	ATM				
931	.8041		1145	T.M.	.8042		1647	ATM				
932	.7917		1146	T.M.	.7918		1646	ATM				
933	.8047		1147	T.M.	.8048		1645	ATM				
* 934	.7981		1148	T.M.	.7918		1644	ATM	.7917	3/16/99	2130	Jm
935	.7861		1149	T.M.	.7861		1643	ATM				
936	.7827		1150	T.M.	.7828		1643	ATM				
937	.7935		1151	T.M.	.7933		1642	ATM				
938	.8086		1152	T.M.	.8084		1641	ATM				
939	.8060		1153	T.M.	.8058		1640	ATM				
940	.8151		1154	T.M.	.8151		1639	ATM				
941	.8252		1155	T.M.	.8249		1638	ATM				
942	.7982		1156	T.M.	.7983		1637	ATM				
943	.7822		1157	T.M.	.7822		1636	ATM				
* 944	.7938		1158	T.M.	.7968		1635	ATM	.7968	3/16/99	2131	Jm
945	.7944		1159	T.M.	.7943		1635	ATM				
946	.7859		1200	T.M.	.7850		1634	ATM				
947	.7731		1201	T.M.	.7735		1633	ATM				
948	.7936		1202	T.M.	.7940		1632	ATM				
949	.7838		1203	T.M.	.7837		1631	ATM				
950	.8040		1204	T.M.	.8038		1630	ATM				

Checked by Jm Date: 3/16/99 Time 2133

QA REWEIGH

Filter #	WT	Date	Time	By
929	.7912	3/16/99	2136	Jm
941	.8248	3/16/99	2134	Jm
949	.7837	3/16/99	2133	Jm

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
64	79	43	3/6/99	1135	ATM
66	81	45	3/15/99	1622	ATM
65	82	39	3/16/99	2025	ATM

Post Test Weighing Session Scale Check

1st	2nd	3rd	QC
0.0000	0.0000	0.0000	Δ.0001
1.0000	1.0000	1.0000	0.9999

WOODSTOVE DATA SHEET #4-2:
INITIAL BEAKER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date: 8/20/99 Time: 1500 By: A.T. Myren

	Beaker #	First Wt	Date	Time	By	Second Wt	Date	Time	By	Third Wt	Date	Time	By
Glass	1	65.4841	8/27	2059	JM	65.4835	8/30/99	1211	ATM				
	2	66.1509	8/27	2118	JM	66.1514		1204	ATM				
	3	67.8582		2116	JM	67.8578		1207	ATM				
	4	67.5890		2108	JM	67.5891		1210	ATM				
	6	67.4270		2119	JM	67.4274		1213	ATM				
	7	65.5444		2105	JM	65.5446		1220	ATM				
	8	66.0219		2121	JM	66.0218		205	ATM				
	9	66.9297		2120	JM	66.9296		1215	ATM				
	10	66.0906		2114	JM	66.0902		1209	ATM				
	11	65.7072		2112	JM	65.7020		1217	ATM	65.7028	9/8/99	1717	JM
	13	57.8946	↓	2110	JM	57.9948	↓	1218	ATM				
										65.7021	9/11	1232	ATM
										65.7022	9/13	1934	JM
SS	20	73.3159	8/27	2125	JM	73.3160	8/31/99	1320	ATM				
	21	71.0002	8/27	2126	JM	71.0003	↓	1325	ATM				
	22	71.8322	9/11/99	1240	ATM	71.8322	9/13	1719	JM				
	23	70.7376	8/27	2131	JM	70.7382	8/30/99	1259	ATM	70.7376	9/8	1715	JM
	24	73.2173	8/27	2130	JM	73.2182		1301	ATM	73.2176	9/8	1713	JM
	25					72.6505	↓	1257	ATM	72.6504	9/8	1716	JM
	26	71.7865	8/27	2132	JM	71.7868	8/31/99	1322	ATM				
	27	72.3294	9/11/99	1235	ATM	72.3294	9/8	1718	JM				
	28	70.5955	8/27	2127	JM	70.5956	8/31/99	1324	ATM				
	29	71.5183	8/27	2133	JM	71.5185	↓	1318	ATM				
	30	70.7845	8/27	2128	JM	70.7855	8/30/99	1309	ATM	70.7851	9/8	1714	JM
	31	69.6652	8/27	2129	JM	69.6655	8/31/99	1327	ATM				
cont. 23	23	70.7375	9/11	1239	ATM								
cont. 24	24	73.2175	9/11	1242	ATM								

Checked By: A.T. Myren Date: 9/11&13/99 Time: ATM

QA REWEIGH

Beaker #	WT	Date	Time	By

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
68	93	46	8/27/99	2052	ATM
67	91	43	8/30/99	1154	ATM
63	76	48	8/31/99	1310	ATM
70	84	47	9/8/99	1705	ATM
69	84	46	9/11/99	1202	ATM
64	77	49	9/13/99	1926	ATM

WOODSTOVE DATA SHEET #4-2:
INITIAL BEAKER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date: 6/1/99 Time: 1400 By: A.T.Myren

Beaker #	First Wt	Date	Time	By	Second Wt	Date	Time	By	Third Wt	Date	Time	By
1	65.4847	7/17/99	1636	OBM	65.4847	7/18/99	1612	ATM	← B KAN	K		
2	66.1504		1638	OBM	66.1506	↓	1614	ATM	7/	13/99		
3	67.8572		1640	OBM	67.8567	↓	1616	ATM				
4	67.5881		1642	OBM	67.5880	↓	1618	ATM				
6	67.4268		1644	OBM	67.4266	↓	1620	ATM				
7	65.5436		1648	OBM	65.5437	↓	1622	ATM				
8	66.0212		1650	OBM	66.0211	↓	1623	ATM				
9	66.6294		1652	OBM	66.6295	↓	1625	ATM				
10	66.0889		1654	OBM	66.0888	↓	1627	ATM				
11	65.7015		1656	OBM	65.7013	↓	1628	ATM				
12	56.0656		1658	OBM	56.0653	↓	1632	ATM				
13	57.8948	↓	1700	OBM	57.8944	↓	1630	ATM				

Checked By: A.T.Myren Date: 7/18/99 Time: 1800

QA REVIEW

Beaker #	WT	Date	Time	By

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
65	78	49	7/17/99	1825	ATM
63	77	45	7/18/99	1604	ATM

WST5-Form9, Pg1, Rev4/90
Unit Lennox Wood Classic
Run # EPA 17
Date: 9/18/99

WOODSTOVE DATA SHEET #4-3: CONSTANT FINAL WEIGHTS

FINAL BEAKER WEIGHTS

Beaker #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
27	✓	9/23/99	0105	ATM	72.3403	9/24	1156	ATM	(72.3402)	9/27/99	2008	Jm				

FINAL FILTER WEIGHTS

Filter #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
F 942	.8410	9/18	1220	ATM	.8384	9/19	1301	TM	.8376	9/23/99	2040	Jm	.8373	9/24	1208	ATM
					.8368	9/27	2015	Jm	(.8369)	9/28/99	1345	ATM				
K 941	.8270	9/18	1221	ATM	.8255	9/19	1300	TM	.8253	9/23	2044	Jm	.8251	9/24	1203	ATM
					(.8251)	9/27	2012	Jm								

*) Filters wet from condensation from cooling. Were loosing wt on scale

QA REWEIGH: FINAL WEIGHTS

Date	Beaker #	Final Wt	By

Date	Filter #	Final WT	By

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	1999 Date	Time	By	WB	DB	%RH
1	9/19	1245	ATM	62	75	47
2	9/23	0028	ATM	65	79	47
3	9/24	1145	ATM	64	72	49
4	9/27	2000	ATM	59	71	48
5	9/28	1340	ATM	58	70	48

SCALE ROOM ENVIRONMENTAL CONDITIONS

6							
7							
8							
9							

Comments

WOODSTOVE DATA SHEET #4-3: CONSTANT FINAL WEIGHTS

Blank
7/18/99

WST5-Form9, Pg1, Rev4/90
Unit Kuma Wood Classic
Run #
Date: 7/ 199

FINAL BEAKER WEIGHTS

Beaker #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
1	✓	7/21/99	1435	ATM	65.4852	8/4/99	1715	ATM	65.4846	8/8/99	1742	DBH	65.4847	8/9	1642	ATM

FINAL FILTER WEIGHTS

Filter #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By

QA REWEIGH: FINAL WEIGHTS

Date	Beaker #	Final Wt	By
Date	Filter #	Final WT	By

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	1999 Date	Time	By	WB	DB	%RH
1	8/4	1705	ATM	69	83	49
2	8/8	1700	ATM	64	78	46
3	8/9	1615	ATM	69	84	46
4						
5						

SCALE ROOM ENVIRONMENTAL CONDITIONS

6						
7						
8						
9						

Comments

WOODSTOVE DATA SHEET #4-4
SCALE QA SHEET

Dates From 1/9/99

Through 7/17/99

Scale Mettler
Model AE100
SN K04827

Level	Recalibrated	100g Weight	10g Weight	1.0g Weight	100mg Weight	20mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	Yes P.O.	99.9999	10.0001	1.0002	.1003	.0203	1/9/99	1243	ATM	58	70	48
✓	No	100.0002	10.0000	1.0000	.1000	.0200	1/14/99	1113	ATM	62	75	47
✓	YES P.O.	99.9998	10.0002	1.0000	.0999	.0201	1/23/99	1100	ATM	63	77	43
✓	YES	99.9999	10.0000	1.0000	.1000	.0201	1/24/99	1318	ATM	59	74	45
✓	YES	99.9996	10.0002	1.0000	.1000	.0200	2/1/99	0910	ATM	55	69	39
✓	YES	99.9997	10.0001	1.0001	.1002	.0201	2/2/99	0939	ATM	60	73	46
✓	YES	99.9999	10.0001	1.0001	.1001	.0200	2/3/99	1555	ATM	63	76	48
✓	YES	99.9999	10.0000	1.0001	.1001	.0201	2/7/99	1235	ATM	62	76	45
✓	YES	99.9998	10.0000	1.0000	.1000	.0200	2/10/99	1600	ATM	63	77	45
✓	YES	99.9998	10.0000	1.0001	.1000	.0200	2/19/99	0246	ATM	64	78	46
✓	NO	99.9999	10.0000	1.0000	.1000	.0200	2/21/99	1312	ATM	65	80	44
✓	NO	99.9997	10.0000	1.0001	.1000	.0200	3/5/99	1935	ATM	64	80	41
✓	YES P.O.	99.9997	10.0000	1.0000	.1001	.0200	3/6/99	1135	ATM	64	76	43
✓	YES	99.9997	10.0000	1.0001	.1000	.0200	3/13/99	1526	ATM	65	80	44
✓	YES	99.9999	10.0001	1.0001	.1001	.0200	3/14/99	1355	ATM	63	78	43
✓	NO	100.0001	10.0000	1.0000	.1000	.0200	3/15/99	1622	ATM	66	81	43
✓	Yes	99.9997	10.0000	1.0001	.1000	.0200	3/16/99	2025	ATM	65	82	39
✓	Yes	99.9996	10.0000	1.0001	.1001	.0200	3/17/99	1615	ATM	62	77	42
✓	Yes	99.9997	10.0000	1.0001	.1000	.0200	3/18/99	2140	ATM	68	84	43
✓	Yes	99.9998	10.0000	1.0000	.1000	.0200	3/20/99	1300	ATM	64	84	32
✓	Yes	99.9999	10.0000	1.0001	.1001	.0201	3/21/99	2215	ATM	61	74	47
✓	Yes	99.9997	10.0000	1.0000	.1001	.0200	3/22/99	0122	ATM	65	85	33
✓	Yes	99.9997	10.0000	1.0001	.1000	.0200	3/23/99	1115	ATM	69	84	46
✓	Yes	99.9997	10.0000	1.0002	.1001	.0201	3/24/99	1120	ATM	72	89	43
✓	Yes	99.9999	10.0000	1.0002	.1001	.0201	3/29/99	2038	ATM	69	72	45
✓	NO	99.9999	10.0002	1.0002	.1001	.0202	3/30/99	0610	ATM	66	80	47
✓	No	99.9999	10.0000	1.0000	.1001	.0201	3/31/99	1000	Jim	64	80	41
✓	NO	99.9996	10.0000	1.0000	.1001	.0201	4/5/99	1730	ATM	64	80	41
✓	Yes	99.9998	10.0001	1.0001	.1001	.0201	4/6/99	1030	ATM	61	75	44
QC Services		Audit	4/6/97	— wt. / Scale check after audit								
✓	NO	100.0003	10.0001	1.0001	.1001	.0201	4/6/99	1730	ATM			
✓	YES	99.9998	10.0001	1.0001	.1001	.0200	4/7/99	1724	ATM	65	85	33
✓	NO	99.9996	10.0000	1.0001	.1001	.0201	4/8/99	1346	ATM	67	80	50
✓	YES	99.9997	10.0000	1.0000	.1000	.0200	4/16/99	1230	ATM	66	82	43
✓	YES	99.9997	10.0000	1.0000	.1000	.0200	4/17/99	1625	ATM	68	84	43
✓	No	99.9999	10.0000	.9999	.0999	.0198	6/9/99	1050	ATM	49	72	45
✓	Yes	99.9996	10.0001	1.0002	.1001	.0202	7/17/99	1825	ATM	65	78	49

WOODSTOVE DATA SHEET #4-4
SCALE QA SHEET

Dates From 7/18/99

Through 9/16/99

Scale Mettler
Model AE100
SN K04827

Level	Recalibrated	100g Weight	10g Weight	1.0g Weight	100mg Weight	20mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	No	99.9996	10.0000	1.0001	.1000	.0201	7/18/99	1604	ATM	63	77	45
✓	YES	99.9997	10.0000	1.0001	.1001	.0201	7/19/99	1835	ATM	64	77	49
✓	Yes	99.9998	10.0000	1.0002	.1002	.0202	7/20/99	1854	ATM	71	85	80
✓	Yes	99.9997	10.0001	1.0001	.1001	.0201	7/21/99	1306	ATM	69	84	50
✓	Yes P.O.	99.9996	9.9999	1.0000	.1000	.0200	7/22/99	2145	ATM	64	80	41
✓	Yes	99.9998	10.0000	1.0000	.1000	.0200	7/23/99	0745	ATM	62	76	45
✓	No	99.9998	10.0000	1.0000	.1000	.0200	7/24/99	1340	ATM	66	80	47
✓	YES P.O.	Would not calibrate					8/3/99	2117	ATM	70	84	49
✓	Yes	99.9998	10.0001	1.0002	.1000	.0201	8/4/99	1705	ATM	69	83	49
✓	NO	99.9998	10.0001	1.0001	.1000	.0200	8/5/99	2106	ATM	65	78	49
✓	Yes	99.9998	10.0000	1.0000	.1000	.0200	8/6/99	1536	ATM	68	81	50
✓	No	99.9999	10.0000	1.0001	.1000	.0200	8/7/99	1515	ATM	66	80	47
✓	Yes	99.9996	10.0001	1.0002	.1001	.0201	8/8/99	1700	ATM	64	78	46
✓	Yes	99.9997	10.0000	1.0001	.1000	.0200	8/9/99	1225	ATM	68	82	48
✓	Yes	99.9998	10.0001	1.0001	.1001	.0200	8/9/99	1615	ATM	69	84	46
✓	No	99.9997	10.0000	1.0000	.1000	.0200	8/10/99	1327	ATM	70	84	49
✓	Yes	99.9998	10.0000	1.0000	.1001	.0200	8/11/99	1043	ATM	67	81	48
✓	Yes	99.9996	10.0000	1.0001	.1001	.0201	8/11/99	2035	ATM	64	78	46
✓	Yes	99.9997	10.0000	1.0001	.1000	.0200	8/13/99	1230	ATM	67	80	47
✓	Yes	99.9998	10.0001	1.0002	.1002	.0201	8/14/99	1929	ATM	63	76	48
✓	Yes	99.9998	10.0000	1.0001	.1001	.0201	8/16/99	1135	ATM	64	77	48
✓	Yes	99.9998	10.0001	1.0001	.1001	.0201	8/17/99	1750	ATM	68	83	46
✓	Yes	99.9997	10.0000	1.0001	.1001	.0200	8/18/99	1650	ATM	70	84	47
✓	No	99.9999	10.0001	1.0000	.1000	.0201	8/27/99	2052	ATM	68	83	46
✓	No	99.9999	10.0001	1.0002	.1001	.0202	8/30/99	1154	ATM	67	81	48
✓	No	99.9998	9.9999	1.0000	.1000	.0200	8/31/99	1310	ATM	63	76	46
✓	Yes	99.9997	10.0000	1.0000	.1000	.0200	8/31/99	1844	ATM	65	79	44
✓	Yes	99.9998	10.0000	1.0000	.1000	.0200	9/2/99	1032	ATM	60	74	43
✓	Yes	99.9998	10.0000	1.0002	.1002	.0200	9/8/99	1705	ATM	70	84	47
✓	YES	99.9996	10.0001	1.0002	.1001	.0201	9/11/99	1202	ATM	69	84	46
✓	Yes	99.9996	10.0000	1.0001	.1001	.0201	9/12/99	2058	ATM	70	84	49
✓	Yes	99.9996	10.0001	1.0001	.1000	.0201	9/13/99	1926	ATM	69	77	49
✓	Yes	99.9997	10.0001	1.0002	.1002	.0202	9/14/99	1335	ATM	61	72	55
✓	Yes	99.9996	10.0001	1.0002	.1002	.0201	9/14/99	2025	ATM	64	78	44
✓	Yes	99.9998	10.0001	1.0000	.1001	.0200	9/15/99	0820	ATM	62	66	42
✓	Yes	99.9996	10.0001	1.0001	.1001	.0201	9/16/99	0845	ATM	69	84	46
✓	No	99.9996	10.0000	1.0000	.1000	.0200	9/16/99	1655	ATM	70	84	49

Dates From 9/17/99

Through _____

WOODSTOVE DATA SHEET #4-4
SCALE QA SHEET

Scale Mettler
Model AE100
SN K04827

Level	Recali-brated	100g Weight	10g Weight	1.0g Weight	100mg Weight	20mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	Yes	99.9998	10.0000	1.0001	.1001	.0201	9/17/99	2045	ATM	66	79	49
✓	Yes	99.9997	10.0000	1.0000	.1001	.0200	9/18/99	1217	ATM	65	76	48
✓	No	99.9996	10.0000	1.0000	.1000	.0200	9/19/99	1245	ATM	62	75	49
✓	Yes	99.9998	10.0001	1.0001	.1001	.0201	9/23/99	2028	ATM	65	79	47
✓	Yes	99.9997	10.0000	1.0000	.1000	.0201	9/24/99	1145	ATM	64	77	49
✓	Yes	99.9997	10.0001	1.0001	.1001	.0200	9/27/99	2000	ATM	59	71	48
✓	No	99.9997	10.0000	1.0000	.1000	.0200	9/28/99	1340	ATM	58	70	48

Woodstove Particulate
Catch Processing Sheet
Woodstove Data Sheet #5
EPA M5G-1

Unit: Kuma Wool Classic
Run: EPA 7
Date: 9/18/99
Technicians: ATM
Revised 1/16/98-Data Sheet #5

Filters

Filter # (Front) 942 Beaker # 27 Final Wt. 72.3402 g
Final Wt. .8369 g Ml 50 Tare Wt. 72.3294 g
Tare Wt. .7983 g Desc. Acetone Net Wt. .0108 g
Net Wt. .0386 g

Filter # (Rear) 941 Beaker # _____ Final Wt. _____ g
Final Wt. .8251 g Ml _____ Tare Wt. _____ g
Tare Wt. .8249 g Desc. _____ Net Wt. _____ g
Net Wt. .0002 g

Acetone Blank Calculation: Blank Date: 7/18/99

Blank Beaker # 1 Final Wt. 65.4847 g
Ml 50 Tare Wt. 65.4847 g
Desc. Acetone Net Wt. .0000 g

.0000 g ÷ 50 ml = .0000 g/ml

Blank Residue Value Calculation:

.0000 g/ml acetone X 50 ml acetone = .0000 g
Blank Residue Value

Total Particulate Catch Calculation

Filter: .0386 g
Filter: .0002 g
Beakers: .0108 g (Total Catch) − .0000 g (Blank Residue Value) = .0108 g
Total Catch = .0496 g

Unit Kuma Wood Classic
Run # EPA 7
Date 9/18/99
Technician ATM JRP
WST6-Form1, Rev8/96

MISCELLANEOUS TEST DATA
WOODSTOVE DATA SHEET #8

Useable Firebox Dimensions: See QC Section Useable Volume: 2.228 ft³

Dilution Tunnel Draft (If applicable): Start .000 Stop .000

Test Chamber Air Velocity: Start: 00.0 Stop: .000 Avg: .000

Wet Bulb/ Start: WB: 62 °F DB: 75 °F 1.40 % Amb Moisture 47 %RH

Dry Bulb Stop: WB: 65 °F DB: 78 °F 1.60 % Amb Moisture 49 %RH

$\bar{X}$ = 1.50 % Ambient Moisture $\bar{X}$ = 48.0 % Relative Humidity (RH)

Empty Stove Wt: 419.3 lbs.

Empty Stove Wt with Stack (Inc. Oil Seal) Wet: 510.7 lbs. Dry: 509.4 lbs.

Empty Stove Wt with Stack and Ash Ash: — lbs. Total: — lbs.

Kindling Wt. Paper: 0.5 lbs. Wood: 5.7 lbs.

Pre Burn Fuel Wt. 14.6 + 15.5 + 16.3 Total: 46.4 lbs. ✓

Total Kindling and Pre Burn Fuel Wt ✓ ✓ 52.6 lbs. ✓

Coal Bed Wt-lbs: Range (3.6 - 3.0) 513.0 - 512.4 lbs. Actual: 3.4 lbs. 512.8

Allowable Amount of Charcoal that can be removed:

Coal Bed Wt. Range 3.6 (Upper Wt.) + 3.0 (Lower Wt.) /2 X .25 = 0.8 ✓ lbs.

Test Fuel Wt-lbs: Ideal 15.6 lbs. Range: 17.1-14.1 lbs. Actual: 14.6 lbs.

Test Fuel Size (pcs.) (.75 x 1.5 x 5" Flanges) 16 Pcs.

2 x 4's x 16 5/8 " 3 Pcs 6.3 lbs. 43.15 % ✓

4 x 4's x 16 5/8 " 2 Pcs 8.3 lbs. 56.85 % ✓

Est. Dry Burn Rate (Kg/Hr.) $\frac{14.6 - (14.6 \times .1783)}{2.2046} \times \frac{60}{82} =$ 3.9817 Est. Dry Burn Rate (Kg/Hr) ✓

Est EPA Heat Output (HO_E) (Avg BTU's/Hr) (19,140) X $\frac{63}{100}$ x 3.9817 = 48,012.1 Est Heat Output (HO_E) BTU's/Hr ✓

Comments:

Stove Operating Data
Woodstove Test Data Sheet #9
Cold Start - High Burn

Unit: Kuma Wood Classic
Run: EPA 7
Date: 9/18/99
Technician(s): ATM ZRP
Data Sheet #9 - Rev 1/98-Pg.5

Fire Started: 0612 POST

Warm up and Preburn: Primary Air: Wide open from ignition until the start of the test. At the run setting of wide open until the start of the test. High burn.

Secondary Air: No Controls. Naturally Drafted.

Secondary Burn/Cat Bypass: N/A

Charcoal Bed Preparation: Broke up, raked and leveled the coal bed prior to the addition of each warm up/pre burn fuel charge. Starting 1:30 before the start of the test, broke up, raked and leveled the coal bed. In stove for 35 seconds.

Test: Door wide open during loading 0 min 55 sec, then Closed

Primary Air: Wide open from the start of the test (0:00) until the end of the test. High Burn.

Secondary Air: No Controls, Naturally drafted.

Secondary Burn/Cat Bypass: N/A

Fan: ON/OFF during the warm up ON/OFF High during the preburn, ON/OFF at the start of the test, ON/OFF for the first 1 minutes of the test, ON/OFF high at 1:00 minutes into the test, ON/OFF for the rest of the test.

Test Run Anomalies:
This run went much faster than expected.

Unit Kuma Wood Classic
Run # EPA 7
Date Sept 13, 1999
Technician ATM JRP

WST7-Form2-A, Rev10/88

WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-1

Wood Data: Kindling: A mix of the below grades

	Size	Mill	Grade	Species
Pre Burn	2X4	CANYON	#2 & BTR	D.FIR CFC GRN
Test Fuel	2X4	CANYON	#2 & BTR	D.FIR CFC GRN
	4X4	"	#1	D.FIR SFC. GRN

All grades WCLB Rules unless otherwise noted.

Warm up Information:

1st Warm up/Pre Burn Fuel charge (14.6 lbs) added at 0635.
2nd Warm up/Pre Burn Fuel charge (15.5 lbs) added at 0729.
3rd Warm up/Pre Burn Fuel charge (16.3 lbs) added at 0825.
4th Warm up/Pre Burn Fuel charge (_____ lbs) added at _____.
5th Warm up/Pre Burn Fuel charge (_____ lbs) added at _____.
6th Warm up/Pre Burn Fuel charge (_____ lbs) added at _____.
7th Warm up/Pre Burn Fuel charge (_____ lbs) added at _____.
8th Warm up/Pre Burn Fuel charge (_____ lbs) added at _____.

The coals were scooped out of the stove immediately prior to adding the 3rd pre burn/warm up fuel charge. The stove lost 13 lbs. 3.5 lbs of coals were put back in after the scoop.

All pre burn/warm up fuel pieces were ~~either~~ ____ to 16" inches long. All preburn pieces/fuel charges were "ricked" in the stove. The pieces in the bottom layer in each rick contained 2 pcs that were 16 inches long and were loaded flat and perpendicular to the door. The pieces in the second layer in each rick were loaded on their side (edge) approximately parallel to the door and contained 4 pcs 16 inches long. The third layer (and fourth layer if present) was loaded flat, perpendicular to the door and contained 2 or 3 pcs 16 inches long. The majority of the pieces in each rick were in the second layer which had an approximate 0.5-1.0" space between pieces. (The loading directions indicate the direction of the longest dimension on each piece relative to the loading door opening.) Each pre burn/warm up fuel charge normally weighs within the weight range allowed for the actual test fuel charge 2nd & 3rd ricks had 3 pcs in third layer.

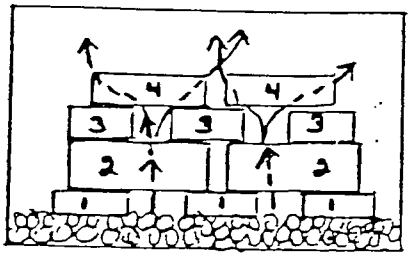
Unit Kuma Wood Classic
Run # EPA-7
Date Sept 18, 1979
Technicians ATM, JZP

WST7-Form2-A, Rev 6/90

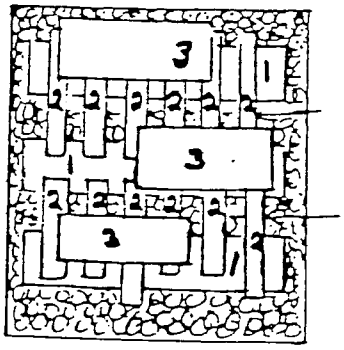
WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-2

Warm up Information (cont.):

Each warm up/preburn fuel charge was ricked in exactly (as much as possible) the same manner and the weight of each rick was usually within the allowable weight range for the test fuel charge. The physical arrangement and alignment of each rick was designed to accomplish three (3) things: (1)The bottom layer was nestled firmly into the coal bed and was as close to being level with the bottom of the stove as possible, thus providing a stable loading platform for the rest of the rick, keeping it in a ricked state (as opposed to a col- lapsed or fallen down state) untill the rick reached the charcoal stage and sags or collapses of its own accord. (2) It enhances the flow of primary air through the ricked preburn fuel charge, for the primary air would flow through the spaces between the pieces in the first layer and then up through the spaces between the pieces in the second, third and, if present, fourth layers. (3) It maximized, as much as possible, the surface to volume ratio of each preburn fuel charge, thereby allowing the fire immediate access to as much wood surface as possible and, thereby, insuring uniform charcoalization. All three of these enhance combustion and so get the stove as hot as possible during the warm up period, therby maximizing the amount of heat (BTU's) stored in the stove. The actual preburn was not started until the stove surface temperatures had maximized and stabilized, thus indicating that the amount of heat stored in the stove had peaked. For this stove, the thermal storage was monitored using the Top T/C surface temperature(s) and the peak value(s) obtained were 953 °F.



Front View



Top View

The arrows indicate the direction of the air flow through the rick.

The primary air was adjusted to the run setting of Wide Open 52.6 lbs above the upper charcoal bed weight.

Unit Kuma Wood Classic
Run # EPA7
Date 9/18/99
Technician AM
Page 3 of 3
WST5-Form2-Rev11/89

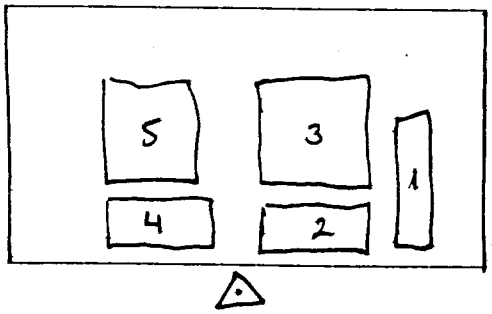
WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-3

Additional Comments: Test Start Sequence: ① Turned Fan Off ② Opened door ③ Loaded Test fuel ④ cleared coals away from in front of the LPAO ⑤ Photo ⑥ Closed door.

Total Elapsed Time: 0:55

Test Fuel Charge Loading Information:

Test Fuel Charge and Loading Sequence Diagram



Front of stove view

4 X 4's: 3 & 5

2 X 4's: 1, 2 & 4

Loading Sequence: 1, 2, 3, 4 and then 5

Driest Pcs in Load 2 & 4, 3

Loaded the test fuel charge on an essentially level, medium-large sized, hot coal bed (in appearance, color and temperature for a high burn rate. Load: 0:55 Ignition: @ 0:20. This run took off like a shot and never once looked back. Fire box was engulfed in flames by 1:55. The CO was higher than expected due to the faster than expected OBR.

Unit: Kuma Mod Classic
Run: EPA #1
Date: 9/13/91
Technician: ATM JRP
WST1-Form7-Rev11/89

FUEL MOISTURE
WOODSTOVE TEST DATA SHEET #10

Room Temperature: 62 °F

Correction Factor: +1

NOTE: Record readings to the nearest 0.5% moisture
Uncor Values are corrected for temperature: Yes ✓. No ___
Time Test Fuel Moisture Readings taken at: 0736
Calibration Checks: X — Y — 12.5 12.0 22.0 22.3

Pc #	Dimen	Use	Top		Bottom		Side		Piece Avg Corrected
			Uncor	Cor	Uncor	Cor	Uncor	Cor	
1	2X4X10'	K	14.0	14.9	14.5	15.4	14.0	14.9	15.067
2									
3									
4	2X4X8'	P	19.5	20.9	13.5	19.8	19.0	20.3	20.333
5	↓	↓	22.0	23.7	22.0	23.7	19.0	20.3	22.567
6	↓	↓	21.0	22.6	21.0	22.6	19.0	20.3	21.833
7	↓	↓	19.0	20.3	19.5	20.9	20.0	21.4	20.867
8									85.600
9									
10	2X4X16'½	T	22	23.7	21	22.6	20	21.4	22.567
11	↓	↓	18	19.2	19.5	20.9	20	21.4	20.500
12	↓	↓	19	20.3	20.5	22.0	20	21.4	21.233
13									
14	4X4X16'½	T	21	22.6	22	23.7	20.5	22.0	22.767 LP
15	↓	↓	20.5	22.0	20.5	22.0	19	20.3	21.433 HD
16									108.500
17									
18									
19	1.75X5X.75	T	21	22.6	20	21.4	19	20.3	21.433
20									Out 5 pieces

	Kindling	Pretest Fuel	Test Load
% Moisture - Dry Basis:	15.067 %	21.400 %	21.700 %
% Moisture - Wet Basis:	13.094 %	17.628 %	17.831 %

To obtain Wet from Dry: $\frac{100 \times \%\ \text{Dry Rdg.}}{100 + \%\ \text{Dry Rdg.}}$ = % Moisture, Wet Basis

Acceptable Ranges: 16-20% wet; 19-25% dry
(17.5 - 22.5 on Meter [Uncor reading] at 70°F)

Key for Use: K= Kindling P= Pretest Fuel T= Test Fuel

Unit: Kuma Wood Classic
Run#: EPA 7
Date: 9/18/99
Technician: ATM

WOOD DENSITY DETERMINATION
WOODSTOVE TEST DATA SHEET #11

WST2-form11-Rev 6/90

Wood Piece: Nominal Dimensions: 3.5 x 3.5 x 1.5

Depth (D): IN 3.487 cm 8.857

Width (W): IN 1.530 cm 3.886

Length (L): IN 3.429, IN 3.448, IN 3.484, IN 3.478

Length $\bar{X}$ = IN 3.460 cm 8.788

Volume: 302.468 cm^3 (D X W X L)

MOISTURE: Room Temperature: 62 °F Correction Factor: +1

Uncorrected Meter Readings Corrected for temperature: Yes ✓ No

NOTE: Record moisture meter readings to the nearest 0.5%

	Uncor	Cor
Top:	18.0	19.2 %
Bottom:	18.0	19.2 %
Side:	19.5	20.9 %
$\bar{X}$:		19.767 %

Avg % Moisture (Dry) 19.767 %

Aug % Moisture (Wet) 16.504 %

Scale: Leveled In ✓ Out ✓

Zeroed: In ✓ Out ✓

Wet Weight: 147.1 g Dry Weight: 125.9 g

% Moisture Dried Basis: 14.412 %
[1 - (Dry Wt ÷ Wet Wt)] X 100

	Date	Time	Temp
Into Dryer	9/18/99	1200	206 °F
Out of Dryer	9/22/99	1551	214 °F

(Minimum Time in Dryer: 24 hrs.) Minimum Dryer Temp 100°C (212°F)

Density = 125.9 g (dry wt) ÷ 302.468 cm^3 (volume) = 0.4162 g/cm^3

Pellet Fuel Moisture Content Determination

Tare Beaker Wt. _____ g

Wet Wt: _____ g - _____ g = _____ g
Gross Wet Wt. Tare Beaker Wt. Net Wet Wt.

Dry Wt: _____ g - _____ g = _____ g
Gross Dry Wt. Tare Beaker Wt. Net Dry Wt.

% Moisture Dried Basis: _____ %
[1 - (Net Dry Wt ÷ Net Wet Wt.)] X 100

BURN RATE AND FLUE GAS DATA
WOOD STOVE DATA SHEET #12
WST2-Form 14 Rev 1/88

Unit: Kuma Wood Classic Date: 9/18/99
Run: EPA 7 Technician(s): A. JRP
Page: 1 of 1

END Wt: 512.8 lbs.

Minute / Time	Scale Wt	lbs left	Burn Rate	1 CO2 v.	1 CO2 %CO2	2 O2 v.	2 O2 %O2	Tel	3 CO v.	3 CO %CO	T/C(1) Bal	T/C(2) Wet Bulb	T/C(2) Dry Bulb	% H2O	Calc W/B	T/C(3) Stack	4 SO2 v.	4 SO2 PPM	Static Press.	Comments
0 / 950	527.4	14.6	0	.315	7.81	50.0	12.49		3.2	.17	45.9	83	131	2.1	125	475			-.068	Flow
5 / 955	525.9	13.1	1.5	.640	15.82	14.2	3.55		43.7	2.24	7.1	117	154	9.2	148	661			-.089	SO_2 1.5
10 / 1000	524.2	11.4	1.7	.646	15.97	14.3	3.58		48.3	2.41	6.6	133	164	15.5	156	696			-.190	CO_2 1.5
15 / 05	522.5	9.7	1.7	.659	16.29	13.3	3.33		42.8	2.12	7.7	134	165	16.0	157	715			-.041	O_2 1.5
20 / 10	520.7	7.9	1.8	.671	16.59	12.3	3.08		33.9	1.70	9.8	133	164	16.0	157	713			-.091	CO 1.5
25 / 15	519.4	6.6	1.3	.611	15.11	18.4	4.60		21.5	1.26	12.0	131	161	15.0	155	674			-.089	
30 / 20	518.2	5.4	1.2	.575	14.22	22.9	5.72		12.4	.60	23.7	127	158	13.5	153	665			-.135	
35 / 25	517.2	4.4	1.0	.579	14.32	21.8	5.45		11.6	.58	24.7	125	157	12.5	151	651			-.086	
40 / 30	516.2	3.4	1.0	.555	13.72	24.5	6.12		3.9	.20	68.6	122	156	11.0	150	685			-.085	
45 / 35	515.5	2.7	.7	.486	12.02	31.6	7.90		1.2	.07	171.8	117	151	9.0	144	610			-.082	
50 / 40	514.9	2.1	.6	.424	10.50	38.1	9.52		1.0	.07	150.0	112	146	8.0	141	578			-.079	
55 / 45	514.3	1.5	.6	.408	10.10	39.5	9.87		1.8	.10	101.0	106	139	6.6	137	549			-.075	
																7683 ✓		-1.013		Flow
60 / 1050	513.9	1.1	.4	.347	8.60	46.3	11.57		2.1	.12	71.7	102	135	5.7	133	530			-.074	SO_2 1.5
65 / 55	513.4	.8	.3	.301	7.47	50.3	12.59		3.8	.20	37.3	95	130	4.3	131	499			-.072	CO_2 1.5
70 / 1100	513.3	.5	.3	.267	6.63	54.1	13.51		4.9	.27	24.5	92	128	3.9	130	481			-.069	O_2 1.5
75 / 05	513.1	.3	.2	.265	6.57	54.3	13.56		4.9	.26	25.3	84	125	3.4	128	461			-.068	CO 1.5
80 / 10	512.9	.1	.2	.262	6.50	54.7	13.66		6.4	.33	19.7	87	123	3.0	125	452			-.065	
85 / 15	512.8	0	.1	.253	6.28	55.6	13.89		7.0	.36	17.4	86	122	3.0	125	444			-.064	
90																2878 ✓		-.412		
95																				
100												18 ±				10561 ✓		-1.425		
105																				
110																587 ✓		-0.0792		
115																				

Pre Burn Stove Wt. 15.9 lbs. Test Stove wt. 528.9 lbs. Range 513.0 - 512.4 lbs.

PRE BURN DATA RECORD SHEET #13
WST2-Form16

BARO. PRESSURE 28.62" Hg

Unit: Kuma Wood Classic Date: 9/10/97
Run: EPA 4 Technician(s): AM. JKP
Page: 1 of 1

T/C#-3 (4) 5 6 7 (8) 9 10 11

Hot Box On ✓

Minute Time	Scale Weight	Burn Rate	Stack	Stove Top	Left Side	Back	Right Side	Bottom	Firebox	2nd Burn ~~Catalytic~~	Room Temp	Static	Comments
0	525	0	403	494	682	486	655	440	849	1124	69	-.080	Primary Air Set at Wide Open
5	530	2.2	728	860	645	407	616	449	769	1579	68	-.095	Secondary Air Set at —
10	535	2.2	740	929	628	370	606	442	738	1586	68	-.096	Fan: High
15	540	2.0	748	939	627	347	609	436	764	1547	69	-.096	TUNNEL ON AT: ✓
20	545	1.7	737	939	645	343	613	431	812	1571	68	-.094	Buckets IN ✓
25	549.4	1.8	726	864	669	350	621	427	874	1524	67	-.093	ANALYZERS SPANNED
30	553.1	1.5	723	939	697	358	633	424	962	1883	69	-.092	Pumps turned on at:
35	556.1	1.2	692	897	726	371	653	425	1054	1695	68	.086	ΔT
40	558.8	1.1	676	868	753	387	675	426	1111	1550	68	.067	
45	561.1	.7	626	811	773	399	692	428	1152	1464	67	.083	Check WB/DB:
50	564.7	1.6	569	730	781	420	701	429	1117	1358	68	.092	
55	566.3	.4	511	624	772	438	705	435	1079	1311	67	.083	
													Probe IN TUNNEL
60	568.0	.3	535	650	741	426	693	438	1038	1298	67	.094	
65	569.7	.3	519	607	727	413	681	437	1015	1283	66	.088	572.8
70	571.4	.3	503	598	711	403	672	435	995	1259	66	.079	560.7
75	573.2	.2	488	560	696	397	662	434	978	1241	67	.079	541.1
80	574.9	.2	491	549	687	396	656	440	961	1214	67	.071	542.5
85	576.8	.2	475	538	682	393	650	442	953	1206	65	.065	✓ 541.0
90													

TEMPERATURES
RECORD SHEET #14
WST2-Form14 Rev7/96

Unit: Kuma Wood Classic Date: 9/18/99
Run: EPA 7 Technician(s): AJM JRP
Page: 1 of 1

T/C#	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Minute / Time	Stove Top	Left Side	Back	Right Side	Bottom	Firebox	2nd Burn ~~Catalytic~~	Room Temp	Tunnel	C. Gas Box	Impinger Out	5G-1 Filter	5G-1 Condenser	Con-dar	2nd burn box
0 950	538	682	393	650	442	953	1206	68	125	236	37	72	5[illegible]	1060	249
5 55	715	668	384	626	448	963	1401	68	153	234	39	72	39	1211	247
10 1000	840	671	365	614	447	880	1513	68	162	238	39	74	39	1264	250
15 05	869	681	357	620	445	908	1584	69	165	241	39	75	39	1460	252
20 10	888	691	358	631	440	937	1480	69	166	243	39	75	39	1416	253
25 15	864	712	376	650	440	993	1396	70	161	245	39	76	39	1352	255
30 20	885	717	384	663	441	1011	1398	70	160	245	39	76	39	1357	252
35 25	805	730	396	691	443	1056	1426	71	157	246	39	75	39	1449	251
40 30	870	740	405	706	442	1085	1417	70	154	246	40	76	39	1438	250
45 35	772	747	434	724	448	1086	1368	71	148	246	38	76	39	1389	248
50 40	723	745	455	732	454	1087	1325	71	143	245	39	76	39	1419	247
55 45	681	741	471	735	461	1094	1291	72	140	244	39	78	39	1350	246
	9370	8805	4778	8047	5351	11953	16,805	837							
60 1050	646	735	480	731	467	1076	1258	73	135	243	39	79	39	1343	244
65 55	596	724	476	717	476	1074	1207	73	133	241	39	77	39	1264	243
70 1100	563	716	471	708	480	1048	1162	74	131	240	39	79	39	1222	242
75 05	533	703	465	695	485	1034	1116	74	128	239	39	79	39	1201	241
80 10	516	693	460	663	486	1017	1125	74	127	238	39	79	39	1201	240
85 15	501	683	459	676	490	1002	1112	73	127	237	39	79	39	1201	240
90	8455	4254	2811	4210	2886	625	7010	441							
95										18÷					
100	12,125	12779	7589	12,257	8237	18,204	23815	1278							
105											DLLIS	Ti	Start	5411.0	✓
110	707	710	422	681	458	1011	1323	71					Stop	5431.8	✓
116													ΔAT	120.8	✓

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-1

Site: Myren Consulting, Woodinville, WA Date: 9/13/99 Analyte: CO_2

Source: Kuma Wood Classic Run #: EPA 7

Zero Cyl #: 719 430 Conc. 00.0 % CO_2 Cyl Press: 1830 psi

Certified by: Oxarc Date: 4/1/99

Span Cyl #: 250-794 Conc. 12.5 % CO_2 Cyl Press: 1305 psi

Certified by: Oxarc Date: 3/26/99

Analyzer: Make: Horiba Model: PIR-2000 SN: 607024

Range: 0 - 25.0% CO_2 Analyzer Output: 0 - 1.0 v.

Flow: 1.5 SCFH Measured by: Rotameter: X Flowmeter:

EPA Span Value = 25.0% CO_2

EPA Control Limits = ± 2.5% of 25.0% CO_2 = ± 0.625% CO_2

Pre Run Audit: By: A.T. Myren Time: 0909 Temp: 77 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	.000	00.0	00.0	.000	.0446	+0.0446	+0.18
Span	50.0	.500	12.5	49.0	.494	12.2232	-0.2768	-2.21

Comments:

Post Run Audit: By: A.T. Myren Time: 1145 Temp: 73 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	.000	00.0	00.0	.000	.0446	+0.0446	+0.18
Span	50.0	.500	12.5	49.0	.493	12.1986	-0.3014	-2.41

Comments:

± Conc. Difference = Act % - Exp (Std) %

Zero % Differece = $\frac{\text{Act \% (ppm)} - \text{Exp \% (ppm)}}{\text{Full Scale Value}} \times 100$

Span % Difference = $\frac{\text{Act \% (ppm)} - \text{Exp \% (ppm)}}{\text{Exp \% (ppm)}} \times 100$

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-2

Site: Myren Consulting, Woodinville, WA Date: 9/13/99 Analyte: O_2

Source: Kuma Wood Classic Run #: EPA 7

Zero Cyl #: 719 430 Conc. 00.0 % O_2 Cyl Press: 1830 psi

Certified by: Oxarc Date: 4/1/99

Span Cyl #: 250-794 Conc. 12.5 % O_2 Cyl Press: 1305 psi

Certified by: Oxarc Date: 3/26/99

Analyzer: Make: Taylor Model: OA 137 SN: 137/4772

Range: 0 - 25.0% O_2 Analyzer Output: 0 - 100 mv.

Flow: 1.5 SCFH Measured by: Rotameter: X Flowmeter:

EPA Span Value = 25.0% O_2

EPA Control Limits = + 2.5% of 25.0% O_2 = + 0.625% O_2

Pre Run Audit: By: A.T.Myren Time: 0909 Temp: 77 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	0.1	00.1	.0300	+0.0300	+0.12
Span	12.5	50.0	12.5	12.5	49.6	12.3909	−0.1091	−0.87

Comments:

Post Run Audit: By: A.T.Myren Time: 1145 Temp.: 73 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	0.1	00.0	.0050	+.0050	+0.02
Span	12.5	50.0	12.5	12.5	49.6	12.3909	−0.1091	−0.87

Comments:

± Conc. Difference = Act % - Exp (Std) %

Zero % Differece = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}} \times 100$

Span % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Exp \% (ppm)}} \times 100$

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-3

Site: Myren Consulting, Woodinville, WA Date: 9/18/99 Analyte: CO

Source: Kuma Wood Classic Run #: EPA 7

Zero Cyl #: 719 4130 Conc. 00.0 % CO Cyl Press: 1830 psi

Certified by: Oxarc Date: 4/1/99

Span Cyl #: 250-794 Conc. 2.50 % CO Cyl Press: 1305 psi

Certified by: Oxarc Date: 3/26/99

Analyzer: Make: Infra Red Model: 702 D SN: 113

Range: 0 - 10.0% CO Analyzer Output: 0 - 100 mv.

Flow: 1.5 SCFH Measured by: Rotameter: X Flowmeter:

EPA Span Value = 5.0% CO
EPA Control Limits = +2.5% of 5.0% CO = + 0.125% CO

Pre Run Audit: By: A.T. Myren Time: 0909 Temp: 77 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	0,00	00.0	-.0093	-.0093	-0.19
Span	2.50	50.0	2.50	2.50	50.0	2.4914	-.0086	-0.34

Comments:

Post Run Audit: By: A.T. Myren Time: 1145 Temp.: 73 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	0,00	00.1	-.0043	-0,0043	-0.09
Span	2.50	51.0	2.50	2.44	48.5	2.4164	-0,0836	-3.34

Comments:

± Conc. Difference = Act % - Exp (Std) %

Zero % Differece = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}} \times 100$

Span % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Exp \% (ppm)}} \times 100$

Unit: Kuma Wood Classic
Run: EPA 7
Date: 9/13/79
Technicians: ATM JZP
WST6-Form3-Rev11/89

QUALITY CHECKS
WOODSTOVE DATA SHEET #16

Ambient = Tr: _____ °F T/C#30: _____ °F

Thermocouple Check (at ambient): T/C#1: 61 °F; T/C#2: 61 °F;
T/C #3: 63 °F; T/C #4: 63 °F; T/C #5: 65 °F;
T/C #6: 65 °F; T/C #7: 64 °F; T/C #8: 65 °F;
T/C #9: 65 °F; T/C #10: 65 °F; T/C #11: 62 °F;
T/C #12: 62 °F; T/C #13: 62 °F; T/C #14: 65 °F;
T/C #15: 61 °F; T/C #16: 62 °F; T/C #17: 65 °F;
T/C #18: 62 °F; T/C #19: — °F; T/C #20: _____ °F;
T/C #21: _____ °F; T/C #22: _____ °F; T/C #23: _____ °F;
T/C #24: _____ °F; T/C #25: _____ °F; T/C #26: _____ °F;

Comments: _____

Thermocouple Readout: Pretest Zero/Span Check and Calibration:

Zero (0°F)	001 °F	Adj to:	— °F	Post Test Check Zero (0°F):	002 °F	% Difference	+0.10
Span (2000°F)	1999 °F	Adj to:	2000 °F	Span (2000°F):	2000 °F		—

(Allowable % Difference = 1.5%. Use formulas on Woodstove Data Sheet #15 to calculate % Difference)

Thermocouple Readout Pretest Linearity Check

0°F = 001 °F; 200°F = 201 °F; 400°F = 398 °F;
600°F = 599 °F; 800°F = 800 °F; 1000°F = 1001 °F;
1200°F = 1200 °F; 1400°F = 1400 °F; 1600°F = 1599 °F
1800°F = 1799 °F; 2000°F = 2000 °F

Combustion Gas (CO_2,O_2,CO) Train Leak Check: Pre ✓ Post ✓
Draft (Static) Guage Zero Check: Pre ✓ ok Post ✓

Scale Check Pre (Wt, #'s): 515.7 - 510.7 = 5.0/5.0 = ok (ATM)
Post (Wt, #'s): 517.1 - 512.1 = 5.0/5.0 = OK (ATM)

Stack cleaned prior to the run: Yes _____ No ✓
Tunnel cleaned prior to the run: Yes _____ No ✓

DILUTION TUNNEL CALCULATIONS — MYREN CONSULTING CERTIFICATION TEST DATA

3/31/96

File Name:	KumaEPA5
Stove Manufacturer:	Kuma
Model Number:	Wood Classic
Lab Name:	MYREN
Test Date:	9\16\99
Run Number:	EPA 5
Meter Box Y Factor:	1.0151
Barometric pressure (in):	28.48
Gas meter temp (ave):	93
delta H(avg):	0.900
Gas meter initial reading:	988.002
Gas meter final reading:	1138.675
Front catch (acetone) mg:	6
first filter catch (mg):	30
second filter catch (mg):	1.9
tunnel flow (ave cfm):	142.767
Emission Rate(g/hr):	2.367
Emission Rate(M5H) :	3.720
vs/VmTs:	0.0108
vs ave:	840.919
Tunnel average temp (°f):	97.643
Test time(min):	270
Fuel Load(lb. wet):	14.6
Wood moisture(%wet):	17.555
Burn rate(dry kg/hr):	1.213
Samp vol(scf):	139.177
front filter number	938
back filter number	937
acetone beaker number	20
PRELIMINARY RESULTS	
FINAL RESULTS	AUDITED

DATA SUMMARY

MODEL :	Wood Classic
RUN:	EPA 5
DATE:	9\16\99
DBR:	1.213
GPH UNADJ	2.367
ADJ	3.72039511

RUN TIME (min)	PITOT DELTAP (- INCH H20)	TNL. TEMP (°F)	GAS METER RDG (ft3)	GAS METER TEMP (°F)	GAS METER DELTA H (in.H2O)	TUNNEL VELOCIT (ft/min)	PROP RATE (%)	dDGM vol std (ft3)
0	0.040	92	988.002	83	0.900	836.67		
10	0.040	104	993.633	84	0.900	845.71	104.3	5.291
20	0.040	101	999.270	85	0.900	843.46	102.6	5.287
30	0.040	103	1004.828	86	0.900	844.96	101.6	5.203
40	0.040	106	1010.390	88	0.900	847.21	101.7	5.188
50	0.040	105	1015.962	90	0.900	846.46	101.0	5.178
60	0.040	107	1021.522	91	0.900	847.96	101.1	5.158
70	0.040	107	1027.085	92	0.900	847.96	100.8	5.151
80	0.040	108	1032.665	92	0.900	848.71	101.3	5.167
90	0.040	106	1038.235	93	0.900	847.21	100.4	5.149
100	0.040	102	1043.790	94	0.900	844.21	99.5	5.125
110	0.040	100	1049.372	94	0.900	842.71	99.9	5.150
120	0.040	99	1054.955	95	0.900	841.95	100.0	5.151
130	0.040	98	1060.525	96	0.900	841.20	99.3	5.121
140	0.040	98	1066.100	96	0.900	841.20	99.5	5.125
150	0.040	96	1071.673	95	0.900	839.69	99.2	5.133
160	0.040	96	1077.240	96	0.900	839.69	99.1	5.118
170	0.040	96	1082.816	95	0.900	839.69	99.5	5.136
180	0.040	94	1088.415	96	0.900	838.18	99.4	5.147
190	0.040	92	1094.005	96	0.900	836.67	99.0	5.139
200	0.040	91	1099.599	96	0.900	835.91	99.1	5.143
210	0.040	90	1105.185	96	0.900	835.15	98.9	5.135
220	0.040	91	1110.785	96	0.900	835.91	99.4	5.148
230	0.040	91	1116.365	97	0.900	835.91	98.7	5.121
240	0.040	90	1121.940	96	0.900	835.15	98.7	5.125
250	0.040	89	1127.524	96	0.900	834.39	98.7	5.134
260	0.040	91	1133.095	96	0.900	835.91	98.9	5.122
270	0.040	91	1138.675	96	0.900	835.91	98.9	5.130
280						0.00	0.0	0.000
290						0.00	0.0	0.000
300						0.00	0.0	0.000
310						0.00	0.0	0.000
320						0.00	0.0	0.000
330						0.00	0.0	0.000
340						0.00	0.0	0.000
350						0.00	0.0	0.000

METHOD 5G-1 PARTICULATE SAMPLING DATA Kuma LAB-

DATE 9/16/1999 PAGE 1 OF 2 MODEL # Wood Classic RUN # EPA 5

METER BOX # 511-M METER Y 1.0151 FILTER # (F) 938 (R) 937

PRE TEST LEAK RATE = .000 CFM @ -15.5 IN. HG .7455/.7455 FILTER SIZE: 110 mm

POST TEST LEAK RATE = .000 CFM @ -15.0 IN. HG .011/.011 PROBE LENGTH 24" g/ss

TIME		METER READING CU.FT.	PITOT dp	TNL TEMP. (°F)	METER TEMP. (°F)	GAS METER dh	VAC IN. Hg
CLOCK	ELAPSED						
1255	00	988.002	.040	92	83	.90	0
1305	10	993.633	.040	104	84	.90	0
15	20	999.270	.040	101	85	.90	0
25	30	1004.828	.040	103	86	.90	0
35	40	1010.390	.040	106	88	.90	0
45	50	1015.962	.040	105	90	.90	0
55	60	1021.522	.040	107	91	.90	0
1405	70	1027.085	.040	107	92	.90	0
15	80	1032.6665	.040	108	92	.90	0
25	90	1038.235	.040	106	93	.90	0
35	100	1043.790	.040	102	94	.90	0
45	10	1049.372	.040	100	94	.90	0
55	20	1054.955	.040	99	95	.90	0
1505	30	1060.525	.040	98	96	.90	0
15	40	1066.100	.040	98	96	.90	0
25	50	1071.673	.040	96	95	.90	0
35	60	1077.240	.040	96	96	.90	0
45	70	1082.816	.040	96	95	.90	0
55	80	1088.415	.040	94	96	.90	0
1605	90	1094.005	.040	92	96	.90	0

6.72
31.3
2.3

VELOCITY TRAVERSE

POINT	LOCATION	ΔP	TEMP
N-1	0.5"	.035	94
2	1.5"	.038	94
3	4.5"	.036	94
4	5.5"	.033	94
W-1	0.5"	.035	94
2	1.5"	.040	94
3	4.5"	.039	94
4	5.5"	.038	94
.03675	Avg.	.037	94.000

Pilot Leak Check Pre ✓ Post ✓

Cp = 0.99

N
1
2
→ W 1 2 (3 ¼ 4)
3
4

*=point of Avg. delta p

$Qs = \left(\sqrt{\frac{\Delta P \times BP}{T(°R)}}\right) \times 3167.2 =$

137.760 cfm

BP = START 28.52 in Hg

60	28.48
120	28.47
180	28.47
240	28.47
270	28.47

$\bar{X} = 28.480$ ✓

METHOD 5G-1 PARTICULATE SAMPLING DATA Kuma L

DATE 9/16/1999 PAGE 1 OF 2 MODEL # Wood Classic RUN # EPA 5

METER BOX # 511-M METER Y 1.0151 FILTER # (F)938 (R)

PRE TEST LEAK RATE = .000 CFM @ -15.5 IN. HG .7455/.7455 FILTER SIZE: 110 mm

POST TEST LEAK RATE = .000 CFM @ -15.0 IN. HG .011/.011 PROBE LENGTH 24" g/a

TIME		METER READING CU.FT.	PITOT dp	TNL TEMP. (°F)	METER TEMP. (°F)	GAS METER dh	VAC IN. Hg
CLOCK	ELAPSED						
1615	00	1099.599	.040	91	96	.90	0
25	10	1105.185	.040	90	96	.90	0
35	20	1110.785	.040	91	96	.90	0
45	30	1116.365	.040	91	97	.90	0
55	40	1121.940	.040	90	96	.90	0
1705	50	1127.524	.040	89	96	.90	0
15	60	1133.095	.040	91	96	.90	0
25	70	1138.675	.040	91	96	.90	0
	80	(150.673)					
	90						
	00						
	10						
	20						
	30						
	40						
	50						
	60						
	70						
	80						
	90						

VELOCITY TRAVERSE

POINT	LOCATION	ΔP	T
N-1	0.5"	.035	9
2	1.5"	.038	9
3	4.5"	.036	9
4	5.5"	.033	9
W-1	0.5"	.035	9
2	1.5"	.040	9
3	4.5"	.039	9
4	5.5"	.038	9
	Avg.	.03675	94

Pilot Leak Check ✓
Pre ____ Post ____

Cp = 0.99

N
1
2
→ W 1 2 (3*)
3
4

*=point of Avg. delta p

$Qs = \left(\sqrt{\frac{\Delta P \times BP}{T(°R)}}\right) \times 3167.2$

137.760 cfm

BP = ~~START~~ 28.52 in Hg
60 28.48
120 29.47
180 28.47
240 28.47
270 28.47

$\bar{X}$ = 28.480

WOODSTOVE DATA SHEET #4-1: INITIAL FILTER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date 1/9/99 Time 1445 By ATM Front Half ✓ Back Half ✓

Manufacturer: Schleicher & Schuell Size: 11 cm Lot.No.: Z8961 Grade: #25 Glass
Order No: 06220

	Filter #	First Wt	Date	Time	By	Second Wt	Date	Time	By	Third Wt	Date	Time	By
	926	.7740	3/6/99	1140	T.M.	.7739	3/15/99	1652	ATM				
	927	.7938		1141	T.M.	.7938		1651	ATM				
	928	.7985		1142	T.M.	.7985		1650	ATM				
	929	.7909		1143	T.M.	.7912		1649	ATM				
	930	.7948		1144	T.M.	.7950		1648	ATM				
	931	.8041		1145	T.M.	.8042		1647	ATM				
	932	.7917		1146	T.M.	.7918		1646	ATM				
	933	.8047		1147	T.M.	.8048		1645	ATM				
*	934	.7981		1148	T.M.	.7918		1644	ATM	.7917	3/16/99	2130	JM
	935	.7861		1149	T.M.	.7861		1643	ATM				
	936	.7827		1150	TM	.7828		1643	ATM				
	937	.7935		1151	T.M.	.7933		1642	ATM				
	938	.8086		1152	TM	.8084		1641	ATM				
	939	.8060		1153	TM	.8058		1640	ATM				
	940	.8151		1154	TM	.8151		1639	ATM				
	941	.8252		1155	TM	.8249		1638	ATM				
	942	.7982		1156	TM	.7983		1637	ATM				
	943	.7822		1157	TM	.7822		1636	ATM				
*	944	.7938		1158	TM	.7968		1635	ATM	.7968	3/16/99	2131	JM
	945	.7944		1159	TM	.7943		1635	ATM				
	946	.7852		1200	TM	.7850		1634	ATM				
	947	.7731		1201	TM	.7735		1633	ATM				
	948	.7936		1202	TM	.7940		1632	ATM				
	949	.7838		1203	TM	.7837		1631	ATM				
	950	.8040	✓	1204	TM	.8038		1630	ATM				

Checked by JM Date: 3/16/99 Time 2133

QA REWEIGH

Filter #	WT	Date	Time	By
929	.7912	3/16/99	2136	JM
941	.8248	3/16/99	2134	JM
949	.7837	3/16/99	2133	JM

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
64	79	43	3/6/99	1135	ATM
66	81	45	3/15/99	1622	ATM
65	82	39	3/16/99	2025	ATM

Post Test Weighing Session Scale Check

	1st	2nd	3rd	QC
0.0000	0.0000	0.0000	Δ.0001	
1.0000	1.0000	1.0000	0.9999	

WOODSTOVE DATA SHEET #4-2:
INITIAL BEAKER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date: 8/20/99 Time: 1500 By: A.T.Myren

Beaker #	First Wt	Date	Time	By	Second Wt	Date	Time	By	Third Wt	Date	Time	By
Glass 1	65.4841	8/27	2059	dm	65.4845	8/30/99	1211	ATM				
2	66.1509	8/27	2118	dm	66.1514		1204	ATM				
3	67.8582		2116	dm	67.8578		1207	ATM				
4	67.5890		2108	dm	67.5891		1210	ATM				
6	67.4270		2119	dm	67.4274		1213	ATM				
7	65.5444		2105	dm	65.5446		1220	ATM				
8	66.0219		2221	dm	66.0218		1205	ATM				
9	66.9297		2120	dm	66.9296		1215	ATM				
10	66.0906		2114	dm	66.0902		1209	ATM				
11	65.7072		2112	dm	65.7020		1217	ATM	65.7028	9/8/99	1717	dm
13	57.8946	↓	2110	dm	57.8948	↓	1218	ATM				
									65.7021	9/11	1232	ATM
									65.7022	9/13	1934	dm
SS 20	73.3159	8/27	2125	dm	73.3160	8/31/99	1320	ATM	←			
21	71.0002	8/27	2126	dm	71.0003	↓	1325	ATM				
22	71.8322	9/11/99	1240	ATM	71.8322	9/13	1719	dm				
23	70.7376	8/27	2131	dm	70.7382	8/30/99	1259	ATM	70.7376	9/8	1715	dm
24	73.2173	8/27	2130	dm	73.2182	↓	1301	ATM	73.2176	9/8	1713	dm
25					72.6505	↓	1257	ATM	72.6504	9/8	1716	dm
26	71.7865	8/27	2132	dm	71.7868	8/31/99	1322	ATM				
27	72.3294	9/11/99	1235	ATM	72.3294	9/8	1718	dm				
28	70.5955	8/27	2127	dm	70.5956	8/31/99	1324	ATM				
29	71.5183	8/27	2133	dm	71.5185	↓	1318	ATM				
30	70.7845	8/27	2128	dm	70.7855	8/30/99	1302	ATM	70.7851	9/8	1714	dm
31	69.6652	8/27	2129	dm	69.6655	8/31/99	1327	ATM				
cont. 23	70.7375	9/11	1238	ATM								
cont 24	73.2175	9/11	1242	ATM								

Checked By: A.T.Myren Date: 9/11&13/99 Time: ATM

QA REWEIGH

Beaker #	WT	Date	Time	By

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
68	83	46	8/27/99	2052	ATM
67	81	48	8/30/99	1154	ATM
63	76	48	8/31/99	1310	ATM
70	84	47	9/8/99	1705	ATM
69	84	46	9/11/99	1202	ATM
64	77	49	9/13/99	1926	ATM

WOODSTOVE DATA SHEET #4-2:
INITIAL BEAKER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date: 6/1/99 Time: 1400 By: A.T. Myren

Beaker #	First Wt	Date	Time	By	Second Wt	Date	Time	By	Third Wt	Date	Time	By
1	65.4847	7/17/99	1636	OBM	65.4847	7/18/99	1612	ATM	← B KAN	K		
2	66.1504		1638	OBM	66.1506	↓	1614	ATM	7/	18/99		
3	67.8572		1640	OBM	67.8567	↓	1616	ATM				
4	67.5881		1642	OBM	67.5880	↓	1618	ATM				
6	67.4268		1644	OBM	67.4266	↓	1620	ATM				
7	65.5436		1648	OBM	65.5437	↓	1622	ATM				
8	66.0212		1650	OBM	66.0211	↓	1623	ATM				
9	66.6294		1652	OBM	66.6295	↓	1625	ATM				
10	66.0889		1654	OBM	66.0888	↓	1627	ATM				
11	65.7015		1656	OBM	65.7013	↓	1628	ATM				
12	56.0655		1658	OBM	56.0653	↓	1632	ATM				
13	57.8948		1700	OBM	57.8944	↓	1630	ATM				

Checked By: A.T. Myren Date: 7/18/99 Time: 1800

QA REVIEW

Beaker #	WT	Date	Time	By

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
65	78	49	7/17/99	1825	ATM
63	77	45	7/18/99	1604	ATM

WST5-Form9,Pg1,Rev4/90
Unit: Kuma Wood Classic
Run # EPA 5
Date: 9/16 199

WOODSTOVE DATA SHEET #4-3: CONSTANT FINAL WEIGHTS

FINAL BEAKER WEIGHTS

Beaker #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
20	✓	9/18/99	1210	ATM	73.3225	9/19/99	1252	TM	73.3220	9/24	1200	ATM	73.3220	9/27/99	2005	JM

FINAL FILTER WEIGHTS

Filter #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
F 938	.8397	9/16	1736	ATM	.8391	9/17	2053	TM	.8385	9/18	1248	ATM	.8390	9/19	1307	TM
					.8384	9/23	2043	JM	.8384	9/24	1205	ATM				
R 937	.7956	9/16	1738	ATM	.7951	9/18	1246	ATM	.7955	9/19	1309	TM	.7952	9/23	2044	JM
					.7952	9/24	1204	ATM								

QA REWEIGH: FINAL WEIGHTS

Date	Beaker #	Final Wt	By

Date	Filter #	Final WT	By

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	1999 Date	Time	By	WB	DB	%RH
1	9/17	2045	ATM	66	79	49
2	9/18	1217	ATM	65	78	48
3	9/19	1245	ATM	62	75	47
4	9/23	2028	ATM	65	79	47
5	9/24	1145	ATM	64	77	49

SCALE ROOM ENVIRONMENTAL CONDITIONS

6							
7							
8							
9							

Comments

WOODSTOVE DATA SHEET #4-3: CONSTANT FINAL WEIGHTS

Blank
7/18/99

WST5-Form9, ..61, Rev4/99
Unit Kuma Wood Classic
Run #
Date: 91 199

FINAL BEAKER WEIGHTS

Beaker #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
1	✓	7/21/99	1435	ATM	65.4852	8/4/99	1715	ATM	65.4846	8/8/99	1742	OBH	65.4847	8/9	1642	ATM

FINAL FILTER WEIGHTS

Filter #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By

QA REWEIGH: FINAL WEIGHTS

Date	Beaker #	Final Wt	By

Date	Filter #	Final WT	By

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	1999 Date	Time	By	WB	DB	%RH
1	8/4	1705	ATM	69	83	49
2	8/8	1700	ATM	64	78	46
3	8/9	1615	ATM	69	84	46
4						
5						

SCALE ROOM ENVIRONMENTAL CONDITIONS

6						
7						
8						
9						

Comments

WOODSTOVE DATA SHEET #4-4
SCALE QA SHEET

Dates From 1/9/99
Through 7/17/99

Scale Mettler
Model AE100
SN K04827

Level	Recalibrated	100g Weight	10g Weight	1.0g Weight	100mg Weight	20mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
L	Yes P.O.	99.9999	10.0001	1.0002	.1003	.0203	1/9/99	1243	ATM	58	70	48
L	No	100.0002	10.0000	1.0000	.1000	.0200	1/14/99	1113	ATM	62	75	47
L	YES P.O.	99.9998	10.0002	1.0000	.0999	.0201	1/23/99	1100	ATM	63	77	48
L	YES	99.9999	10.0000	1.0000	.1000	.0201	1/24/99	1318	ATM	59	74	45
L	YES	99.9996	10.0002	1.0000	.1000	.0200	2/1/99	0910	ATM	55	69	39
L	YES	99.9997	10.0001	1.0001	.1002	.0201	2/2/99	0939	ATM	60	73	46
L	YES	99.9999	10.0001	1.0001	.1001	.0200	2/3/99	1555	ATM	63	76	48
L	YES	99.9999	10.0000	1.0001	.1001	.0201	2/7/99	1235	ATM	62	76	45
L	YES	99.9998	10.0000	1.0000	.1000	.0200	2/10/99	1600	ATM	63	77	43
L	YES	99.9998	10.0000	1.0001	.1000	.0200	2/19/99	0246	ATM	64	78	46
L	No	99.9999	10.0000	1.0000	.1000	.0200	2/21/99	1313	ATM	65	80	44
L	No	99.9997	10.0000	1.0001	.1000	.0200	3/5/99	1935	ATM	64	80	41
L	YES P.O.	99.9997	10.0000	1.0000	.1001	.0200	3/6/99	1135	ATM	64	79	43
L	YES	99.9997	10.0000	1.0001	.1000	.0200	3/13/99	1526	ATM	65	80	44
L	YES	99.9999	10.0001	1.0001	.1001	.0200	3/14/99	1355	ATM	63	78	43
L	NO	100.0001	10.0000	1.0000	.1000	.0200	3/15/99	1622	ATM	66	81	45
L	Yes	99.9997	10.0000	1.0001	.1000	.0200	3/16/99	2025	ATM	65	82	39
L	Yes	99.9996	10.0000	1.0001	.1001	.0200	3/17/99	1615	ATM	62	77	42
L	Yes	99.9997	10.0000	1.0001	.1000	.0200	3/18/99	2140	ATM	68	84	43
L	Yes	99.9998	10.0000	1.0000	.1000	.0200	3/20/99	1300	ATM	64	84	32
L	Yes	99.9999	10.0000	1.0001	.1001	.0201	3/21/99	2215	ATM	61	74	47
L	Yes	99.9997	10.0000	1.0000	.1001	.0200	3/22/99	0102	ATM	65	85	33
L	Yes	99.9997	10.0000	1.0001	.1000	.0200	3/23/99	1115	ATM	69	84	46
L	Yes	99.9999	10.0000	1.0002	.1001	.0201	3/24/99	1120	ATM	72	89	43
L	Yes	99.9999	10.0000	1.0002	.1001	.0201	3/29/99	2038	ATM	69	72	45
L	No	99.9999	10.0002	1.0002	.1001	.0202	3/30/99	0610	ATM	66	80	47
L	No	99.9999	10.0000	1.0000	.1001	.0201	3/31/99	1000	ATM	64	80	41
L	NO	99.9996	10.0000	1.0000	.1001	.0201	4/6/99	1330	ATM	64	80	41
L	Yes	99.9998	10.0001	1.0001	.1001	.0201	4/6/99	1030	ATM	61	75	44
QC Services	Audit	4/6/97	- wt.	Scale check after audit								
L	NO	100.0003	10.0001	1.0001	.1001	.0201	4/6/99	1330	ATM			
L	YES	99.9998	10.0001	1.0001	.1001	.0200	4/7/99	1424	ATM	65	85	33
L	NO	99.9996	10.0000	1.0001	.1001	.0201	4/8/99	1346	ATM	67	80	50
L	YES	99.9997	10.0000	1.0000	.1000	.0200	4/16/99	1230	ATM	66	82	43
L	YES	99.9997	10.0000	1.0000	.1000	.0200	4/17/99	1635	ATM	63	84	43
L	NO	99.9999	10.0000	.9998	.0999	.0198	6/9/99	1050	ATM	49	72	45
L	Yes	99.9996	10.0001	1.0002	.1001	.0202	7/17/99	1625	ATM	65	78	49

WST7-Form1-Rev8/96

WOODSTOVE DATA SHEET #4-4
SCALE QA SHEET

Dates From 7/18/99
Through 9/16/99

Scale Mettler
Model AE100
SN K04827

Level	Recali-brated	100g Weight	10g Weight	1.0g Weight	100mg Weight	20mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	No	99.9996	10.0000	1.0001	.1000	.0201	7/18/99	1604	ATM	63	77	45
✓	YES	99.9997	10.0000	1.0001	.1001	.0201	7/19/99	1835	ATM	64	77	49
✓	Yes	99.9996	10.0000	1.0002	.1002	.0202	7/20/99	1854	ATM	71	85	80
✓	Yes	99.9997	10.0001	1.0001	.1001	.0201	7/21/99	1306	ATM	69	84	50
✓	Yes P.O.	99.9996	9.9999	1.0000	.1000	.0200	7/22/99	2145	ATM	64	80	41
✓	Yes	99.9998	10.0000	1.0000	.1000	.0200	7/23/99	0745	ATM	62	76	45
✓	No	99.9998	10.0000	1.0000	.1000	.0200	7/24/99	1340	ATM	66	80	47
✓	YES P.O.	Would not calibrate					8/3/99	2117	ATM	70	84	49
✓	Yes	99.9998	10.0001	1.0002	.1000	.0201	8/4/99	1705	ATM	69	83	49
✓	NO	99.9998	10.0001	1.0001	.1000	.0200	8/5/99	2106	ATM	65	78	49
✓	Yes	99.9998	10.0000	1.0000	.1000	.0200	8/6/99	1536	ATM	68	81	50
✓	No	99.9999	10.0000	1.0001	.1000	.0200	8/7/99	1515	ATM	66	80	47
✓	Yes	99.9996	10.0001	1.0002	.1001	.0201	8/8/99	1700	ATM	64	73	46
✓	Yes	99.9997	10.0000	1.0001	.1000	.0200	8/9/99	1225	ATM	68	82	48
✓	Yes	99.9998	10.0001	1.0001	.1001	.0200	8/9/99	1615	ATM	69	84	46
✓	No	99.9997	10.0000	1.0000	.1000	.0200	8/10/99	1327	ATM	70	84	49
✓	Yes	99.9998	10.0000	1.0000	.1001	.0200	8/11/99	1043	ATM	67	81	48
✓	Yes	99.9996	10.0000	1.0001	.1001	.0201	8/11/99	2035	ATM	64	78	46
✓	Yes	99.9997	10.0000	1.0001	.1000	.0200	8/13/99	1230	ATM	64	80	47
✓	Yes	99.9998	10.0001	1.0002	.1002	.0201	8/14/99	1929	ATM	63	76	48
✓	Yes	99.9998	10.0000	1.0001	.1001	.0201	8/16/99	1135	ATM	64	77	48
✓	Yes	99.9998	10.0001	1.0001	.1001	.0201	8/17/99	1750	ATM	68	83	46
✓	Yes	99.9998	10.0000	1.0001	.1001	.0200	8/18/99	1650	ATM	70	84	47
✓	No	99.9999	10.0001	1.0000	.1000	.0201	8/27/99	2052	ATM	68	83	46
✓	No	99.9999	10.0001	1.0002	.1001	.0202	8/30/99	1154	ATM	67	81	48
✓	No	99.9998	9.9999	1.0000	.1000	.0200	8/31/99	1310	ATM	63	76	48
✓	Yes	99.9997	10.0000	1.0000	.1000	.0200	9/31/99	1844	ATM	65	79	44
✓	Yes	99.9998	10.0000	1.0000	.1000	.0200	9/2/99	1032	ATM	60	74	43
✓	Yes	99.9998	10.0000	1.0002	.1002	.0200	9/8/99	1705	ATM	70	84	47
✓	YES	99.9996	10.0001	1.0002	.1001	.0201	9/11/99	1203	ATM	69	84	46
✓	Yes	99.9996	10.0000	1.0001	.1001	.0201	9/12/99	2058	ATM	70	84	49
✓	Yes	99.9996	10.0001	1.0001	.1000	.0201	9/13/99	1926	ATM	64	77	44
✓	Yes	99.9997	10.0001	1.0002	.1002	.0202	9/14/99	1335	ATM	81	72	63 44
✓	Yes	99.9996	10.0001	1.0002	.1002	.0201	9/14/99	8025	ATM	84	68	44
✓	Yes	99.9998	10.0001	1.0000	.1001	.0200	9/15/99	0820	ATM	83	66	42
✓	Yes	99.9996	10.0001	1.0001	.1001	.0201	9/16/99	0845	ATM	84	84	46

Dates From 9/17/99

Through _____

WOODSTOVE DATA SHEET #4-4
SCALE QA SHEET

Scale Mettler
Model AE100
SN K04827

Level	Recali-brated	100g Weight	10g Weight	1.0g Weight	100mg Weight	20mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	Yes	99.9998	10.0000	1.0001	.1001	.0201	9/17/99	2045	ATM	66	79	49
✓	Yes	99.9997	10.0000	1.0000	.1001	.0200	9/18/99	1217	ATM	65	78	48
✓	No	99.9996	10.0000	1.0000	.1000	.0200	9/19/99	1245	ATM	62	75	49
✓	Yes	99.9998	10.0001	1.0001	.1001	.0201	9/23/99	2028	ATM	65	79	47
✓	Yes	99.9997	10.0000	1.0000	.1000	.0201	9/24/99	1145	ATM	64	77	49
✓	Yes	99.9997	10.0001	1.0001	.1001	.0200	9/27/99	2000	ATM	59	71	48
✓	No	99.9997	10.0000	1.0000	.1000	.0200	9/28/99	1340	ATM	58	70	48

Unit: Kuma Wood Classic
Run: EPA 5
Date: 9/16/ 1999
Technicians: ATM RLS
WST20, Form5

Woodstove Particulate Catch Processing Sheet
Woodstove Data Sheet #5
EPA M5G-1

Filters

Filter # (F) 938 | Beaker # 20 | Final Wt. 73.3220 g
Final Wt .8384 g | Ml 35 | Tare Wt. 73.3160 g
Tare Wt .8084 g | Desc. Acetone | Net Wt. .0060 g
Net Wt .0300 g

Filter # (R) 937 | Beaker # _____ | Final Wt. _____ g
Final Wt .7952 g | Ml _____ | Tare Wt. _____ g
Tare Wt .7933 g | Desc. _____ | Net Wt. _____ g
Net Wt .0019 g

Acetone Blank Calculation: Blank done 7/13/99

Blank Beaker # 1 | Final Wt 65.4847
Ml 50 | Tare Wt 65.4847
Desc Acetone | Net Wt .0000

.0000 g : 50 ml = .0000 g/ml

Particulate Catch Calculation

Filter: .0300 g
Filter: .0019 g
Beakers: .0060 (Total Catch) - (35)(.0000) (Ml of Acetone Blank Value/Ml of Acetone) = .0060 g
Total Catch = .0379 g

Unit Kuma Wood Classic
Run # EPA 5
Date 9/16/1999
Technician ATM P.S. T.P.
WST6-Form1, Rev 8/96

MISCELLANEOUS TEST DATA
WOODSTOVE DATA SHEET #8

Useable Firebox Dimensions: See QC Section Useable Volume: 2.228 ft^3

Dilution Tunnel Draft (If applicable): Start 00.0 Stop 00.0

Test Chamber Air Velocity: Start: 00.0 Stop: 00.0 Avg: 00.0

Wet Bulb/ Start: WB: 62 °F DB: 74 °F 1.5 % Amb Moisture 50 %RH

Dry Bulb Stop: WB: 65 °F DB: 76 °F 1.7 % Amb Moisture 55 %RH

$\bar{X}$ = 1.60 % Ambient Moisture $\bar{X}$ = 52.5 % Relative Humidity (RH)

Empty Stove Wt: 419.3 lbs.

Empty Stove Wt with Stack (Inc. Oil Seal) Wet: 570.8 lbs. Dry: 509.1 lbs.

Empty Stove Wt with Stack and Ash Ash: — lbs. Total: — lbs.

Kindling Wt. Paper: 0.3 lbs. Wood: 4.0 lbs.

Pre Burn Fuel Wt. 14.3 + 14.2 + 14.2 Total: 42.7 lbs. ✓

Total Kindling and Pre Burn Fuel Wt 47.0 lbs. ✓

Coal Bed Wt-lbs: Range (512.7-512.1) 3.6-3.0 lbs. Actual: 3.2 lbs.

Allowable Amount of Charcoal that can be removed:

Coal Bed Wt. Range $\frac{3.6}{\text{Upper Wt.}} + \frac{3.0}{\text{Lower Wt.}}$ 12 X .25 = .8 lbs. ✓

Test Fuel Wt-lbs: Ideal 15.6 lbs. Range: 17.1-14.1 lbs. Actual: 14.6 lbs. ✓

Test Fuel Size (pcs.) (.75 x 1.5 x 5" Flanges) 16 Pcs.

2 x 4's x 15 1/8 " 3 Pcs 6.2 lbs. 42.5 % ✓

4 x 4's x 15 1/8 " 2 Pcs 8.4 lbs. 57.5 % ✓

✓ ✓ ✓

Est. Dry Burn Rate (Kg/Hr.) $\frac{14.1 - (14.6 \times .17555)}{2.2046} \times \frac{60}{270}$ = 1.2133 Est. Dry Burn Rate (Kg/Hr) ✓

Est EPA Heat Output (HO_E) (Avg BTU's/Hr) (19,140) X $\frac{63}{100}$ x 1.2133 = 14,630 Est Heat Output (HO_E) BTU's/Hr ✓

Comments:

Stove Operating Data
Woodstove Test Data Sheet #9
Cold Start

Unit: Kuma Wood Classic
Run: EPA 5
Date: 9/16/99
Technician(s): ATM RLS JRP
Data Sheet #9 - Rev 1/98-Pg.1

Fire Started: 0750 P.D.S.T

Warm up and Preburn: Primary Air: Wide open from ignition until the start of preburn when the primary air control(s) was (were) adjusted to the run setting of 7/16" open. At the run setting until the start of the test.

Secondary Air: No Controls. Naturally drafted.

Secondary Burn/Cat Bypass: N/A

Charcoal Bed Preparation: Broke up, raked and leveled the coal bed prior to the addition of each warm up/pre burn fuel charge. Starting 1130 before the start of the test, broke up, raked and leveled the coal bed. In stove for 35 seconds.

Test: Door wide open during loading 1 min 01 sec, then closed.

Primary Air: Wide open from the start of the test (0:00) until 4155.
Adjusted to the run setting of 7/16" open between 4155 and 5100.
At the run setting of 7/16" open at 5100 into the run.

Secondary Air:
No Controls. Naturally drafted,

Secondary Burn/Cat Bypass: N/A

Fan: OFF during the entire test. Fan Confirmation Test.

Test Run Anomalies: None.

Unit Kuma Wood Classic
Run # EPA 5
Date 9/16/1999
Technician ATM RLS JP
Page 1 of 4
WST7-Form2-A, Rev10/88

WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-1

Wood Data: Kindling: A mix of the below grades

	Size	Mill	Grade	Species
Pre Burn	2X4	Canyon Lumber	#2 & Better	D. Fir SFC Grn
Test Fuel	2X4	Canyon Lumber	#2 & Better	D. Fir SFC Grn
	4X4	R.I.B. Const.	#1	D. Fir SFC Grn

All grades WCLB Rules unless otherwise noted.

Warm up Information:

1st Warm up/Pre Burn Fuel charge (14.3 lbs) added at 0818.
2nd Warm up/Pre Burn Fuel charge (14.2 lbs) added at 0927.
3rd Warm up/Pre Burn Fuel charge (14.2 lbs) added at 1030.
4th Warm up/Pre Burn Fuel charge (lbs) added at .
5th Warm up/Pre Burn Fuel charge (lbs) added at .
6th Warm up/Pre Burn Fuel charge (lbs) added at .
7th Warm up/Pre Burn Fuel charge (lbs) added at .
8th Warm up/Pre Burn Fuel charge (lbs) added at .

The coals were scooped out of the stove immediately prior to adding the 3rd pre burn/warm up fuel charge. The stove lost 1.7 lbs. 3.0 lbs. of coals were put back in the stove after the scoop.

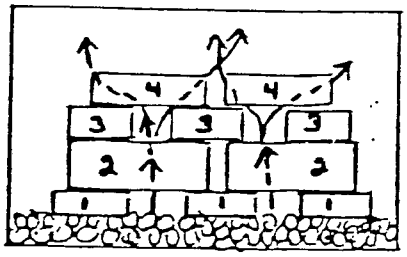
All pre burn/warm up fuel pieces were [redacted] 16" inches long. All preburn pieces/fuel charges were "ricked" in the stove. The pieces in the bottom layer in each rick contained 2 pcs that were 16 inches long and were loaded flat and perpendicular to the door. The pieces in the second layer in each rick were loaded on their side (edge) approximately parallel to the door and contained 4 pcs 16 inches long. The third layer (and fourth layer if present) was loaded flat, perpendicular to the door and contained 2 pcs 16 inches long. The majority of the pieces in each rick were in the second layer which had an approximate 0.5-1.0" space between pieces. (The loading directions indicate the direction of the longest dimension on each piece relative to the loading door opening.) Each pre burn/warm up fuel charge normally weighs within the weight range allowed for the actual test fuel charge

Unit Kuma Wood Classic
Run # EPA 5
Date 9/16/1999
Technician ATM RLS J.P.
Page 2 of 4
WST7-Form2-A, Rev 6/90

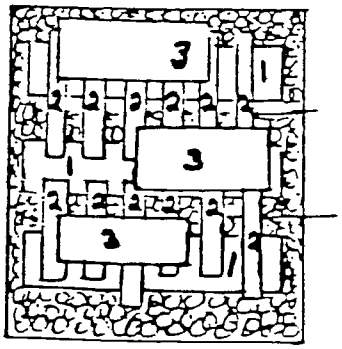
WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-2

Warm up Information (cont.):

Each warm up/preburn fuel charge was ricked in exactly (as much as possible) the same manner and the weight of each rick was usually within the allowable weight range for the test fuel charge. The physical arrangement and alignment of each rick was designed to accomplish three (3) things: (1)The bottom layer was nestled firmly into the coal bed and was as close to being level with the bottom of the stove as possible, thus providing a stable loading platform for the rest of the rick, keeping it in a ricked state (as opposed to a col- lapsed or fallen down state) untill the rick reached the charcoal stage and sags or collapses of its own accord. (2) It enhances the flow of primary air through the ricked preburn fuel charge, for the primary air would flow through the spaces between the pieces in the first layer and then up through the spaces between the pieces in the second, third and, if present, fourth layers. (3) It maximized, as much as possible, the surface to volume ratio of each preburn fuel charge, thereby allowing the fire immediate access to as much wood surface as possible and, thereby, insuring uniform charcoalization. All three of these enhance combustion and so get the stove as hot as possible during the warm up period, therby maximizing the amount of heat (BTU's) stored in the stove. The actual preburn was not started until the stove surface temperatures had maximized and stabilized, thus indicating that the amount of heat stored in the stove had peaked. For this stove, the thermal storage was monitored using the TOP surface temperature(s) and the peak value(s) obtained were 950 °F.



Front View



Top View

The arrows indicate the direction of the air flow through the rick.

The primary air was adjusted to the run setting of 7/16" open 5.5 lbs above the upper charcoal bed weight.

WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-3

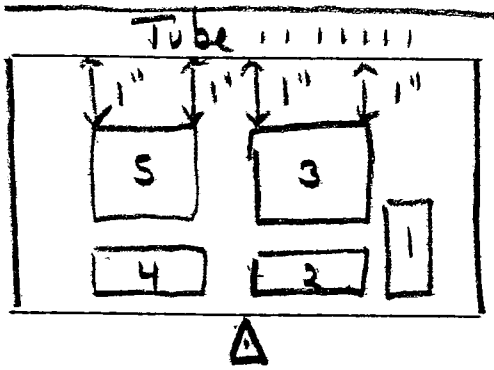
Unit Kuma Wood Classic
Run # EPA 5
Date 9/16/99
Technician AT Ryan
Page 3 of 4
WST5-Form2-Rev11/89

Additional Comments: Test Start Sequence: ① opened primary air control wide open ② opened door ③ loaded test fuel ④ cleared coals away from the LPDO ⑤ Photograph ⑥ closed door.

Total Elapsed Time: 1:01

Test Fuel Charge Loading Information:

Test Fuel Charge and Loading Sequence Diagram



Front of stove view

4 X 4's: 3 & 5

2 X 4's: 1, 2 & 4

Loading Sequence: 1, 2, 3, 4 & then 5 last,

Driest Pcs in Load 2 & 4, 3

Loaded the test fuel charge on an essentially level, Medium sized, Average/cool coal bed (in appearance, color and temperature for a medium low burn rate. The coal bed was not as bright in color orange, More dull.

Ignition 0:33 Load 1:01. VC to baffle 1:05

1:35 VC curling down onto tops of 3 & 5
Flames on left side of L Shape on front.

2:19 Flames/2nds forward past 1st tube, CO @ 1.14%

2:45 Front tube igniting - flickering on/off,

3:00 " " fairly well ignited

(*) 3:19 Gas Balance

5:00 14.0% CO_2 / .30% CO

Unit Kennedy Classic
Run # EPA 5
Date 9/16/99
Technician A.J./Myron
Page 4 of 4
WST5-Form2-Rev10/88

WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-4

Additional Comments:

5100 (Cont.) All Flames ↓. Maintained a hot pocket with a VC to baffle. Also Secondaries / flames above 3 & 5. Secondaries seem unstable. Till N 5:45. Were pulsing a little. Slowly Ok after 5:45. Flames on top of 5 in back.
6115 almost out of balance. VC T and curling onto tops of 3 & 5.
6142 Out of balance 9.0/.91 gases still ↓
7134 Back in 8.3/.81
8100 Barely in. Stable fire. No flames forward past the front tube.
9:00 Gases improving
10:00 in - barely
11:52 Out 8.5/.87 VC ↓ The LPAO and air wash air flows are not as vigorous.
14:30 Back in.
16:00 VC T out again
18:07 Still Out 9.8/1.03
18:30 flames starting to come forward on L. side
19:50 Back in.
21:47 1st flash off front tube
22:30 gases improving 11.7/.62

Unit: Kuma Wood Chair Co.
Run: EPA 5
Date: 9/16/1979
Technician: ATM RLS, J.P.
WST1-Form7-Rev11/89

FUEL MOISTURE
WOODSTOVE TEST DATA SHEET #10

Room Temperature: 70 °F

Correction Factor: 0

NOTE: Record readings to the nearest 0.5% moisture
Uncor Values are corrected for temperature: Yes ✓. No ____
Time Test Fuel Moisture Readings taken at: 1020
Calibration Checks: X — Y — 12.5 12.5 22.0 22.5

Pc #	Dimen	Use	Top		Bottom		Side		Piece Avg Corrected
			Uncor	Cor	Uncor	Cor	Uncor	Cor	
1	2x4x8'	K	12.0	12.8	12.0	12.8	12.5	13.3	(12.967)
2									
3									
4	2x4x8'	P	18.0	19.2	18.0	19.2	18.0	19.2	19.200
5	"	|	22.0	23.7	22.0	23.7	22.0	23.7	23.700
6	"	|	21.0	22.6	21.5	23.1	21.0	22.6	22.767
7	"	↓	20.0	21.4	20.0	21.4	19.5	20.9	21.233
8									(86.900)
9									
10	2x4-15 1/8"	T	18.0	19.2	18.0	19.2	18.0	19.2	19.200
11	"	|	19.0	20.3	19.0	20.3	19.0	20.3	20.300
12	"	↓	22.0	23.7	22.0	23.7	22.0	23.7	23.700
13									
14	4x4-15 1/8"	T	19.0	20.3	18.0	19.2	18.0	19.2	19.567
15	"	↓	22.0	23.7	22.0	23.7	22.0	23.7	23.700
16									(106.467)
17									
18									
19	5x1.5x.75	Spacers	20.0	21.4	20.0	21.4	20.0	21.4	21.400 OUT-Spacers
20									

	Kindling	Pretest Fuel	Test Load
% Moisture - Dry Basis:	12.967 %	21.725 %	21.293 %
% Moisture - Wet Basis:	11.479 %	17.848 %	17.555 %

To obtain Wet from Dry: $\frac{100 \times \%\ \text{Dry Rdg.}}{100 + \%\ \text{Dry Rdg.}}$ = % Moisture, Wet Basis

Acceptable Ranges: 16-20% wet; 19-25% dry
(17.5 - 22.5 on Meter [Uncor reading] at 70°F)

Key for Use: K= Kindling P= Pretest Fuel T= Test Fuel

Unit: Kuma Wood Classic
Run#: EPA 5
Date: 9/16/1999
Technician: ATTM RLS JP

WOOD DENSITY DETERMINATION
WOODSTOVE TEST DATA SHEET #11

WST2-form11-Rev 6/90

Wood Piece: Nominal Dimensions: 3½" X 3½" X 1½" IN

Depth (D): IN 1.521 cm 3.863

Width (W): IN 3.555 cm 9.030

Length (L): 3.508 cm IN
3.505 cm IN
3.503 cm IN
3.498 cm IN

Length $\bar{X}$ = IN 3.504 cm 8.900

Volume: 310.458 cm^3 (D X W X L)

MOISTURE: Room Temperature: 70 °F Correction Factor: 0

Uncorrected Meter Readings Corrected for temperature: Yes ✓ No ___

NOTE: Record moisture meter readings to the nearest 0.5%

	Uncor	Cor
Top:	22.0	23.7 %
Bottom:	22.0	23.7 %
Side:	22.0	23.7 %
$\bar{X}$:		23.700 %

Avg % Moisture (Dry) 23.700 %

Aug % Moisture (Wet) 19.159 %

Scale: Leveled In ✓ Out ___
Zeroed: In ✓ Out ___

Wet Weight: 193.1 g Dry Weight: 162.4 g

% Moisture Dried Basis: 15.899 %
[1 - (Dry Wt ÷ Wet Wt)] X 100

	Date	Time	Temp
Into Dryer	9/16/99	1020	214 °F
Out of Dryer	9/22/99	1549	214 °F

(Minimum Time in Dryer: 24 hrs.) Minimum Dryer Temp 100°C (212°F)

Density = 162.4 g (dry wt) ÷ 310.458 cm^3 (volume) = .5231 g/cm^3

Pellet Fuel Moisture Content Determination

Tare Beaker Wt. _____ g

Wet Wt: _____ g - _____ g = _____ g
Gross Wet Wt. Tare Beaker Wt. Net Wet Wt.

Dry Wt: _____ g - _____ g = _____ g
Gross Dry Wt. Tare Beaker Wt. Net Dry Wt.

% Moisture Dried Basis: _____ %
[1 - (Net Dry Wt ÷ Net Wet Wt.)] X 100

BURN RATE AND FLUE GAS DATA
WOOD STOVE DATA SHEET #12
WST2-Form 14 Rev 1/88

END Wt: 512.3 lbs.

Unit: Kuma Wood Classic Date: 9/16/1[illegible]
Run: EPA 5
Page: 1 of 3
Technician(s): ATM [illegible]

Minute / Time	Scale Wt	lbs left	Burn Rate	CO2 v.	CO2 %CO2	O2 v.	O2 %O2	Tel	CO v.	CO %CO	Bal	T/C(1) Wet Bulb	T/C(2) Dry Bulb	% H2O	Calc W/B	T/C(3) Stack	SO2 v.	SO2 PPM	Static Press.	Comments
0 / 1255	526.9	14.6	0	.254	6.31	52.1	13.02		29.0	1.46	4.3	80	119	2.1	105	362			-.039	Flow
5 / 1300	526.0	13.7	.9	.464	11.48	30.4	7.60		13.1	0.66	17.4	88	134	3.0	129	505			-.075	SO2 1.5
10 / 05	525.4	13.1	.6	.331	8.20	46.9	11.72	GAS BAL.	15.5	0.79	(10.4)	110	152	7.3	129	364			-.057	CO 1.5
15 / 10	524.8	12.5	.6	.347	8.60	45.0	11.24	OUT BAL.	17.3	0.88	(9.8)	116	147	9.2	131	341			-.056	O2 1.5
20 / 15	524.1	11.8	.7	.389	9.63	40.8	10.19		20.5	1.03	9.4	120	148	10.5	134	348			-.057	CO 1.5
25 / 20	523.4	11.1	.7	.461	11.41	34.6	8.65	GAS BAL.	14.1	0.71	(16.1)	123	150	12.0	135	373			-.060	
30 / 25	522.7	10.4	.7	.499	12.35	31.7	7.92		7.9	0.41	30.1	124	153	12.0	138	389			-.062	
35 / 30	522.0	9.7	.7	.544	13.46	27.2	6.80		7.5	0.39	34.5	124	154	12.5	141	402			-.063	
40 / 35	521.3	9.0	.7	.539	13.33	27.9	6.97		6.5	0.34	39.2	125	156	12.0	140	409			-.063	
45 / 40	520.7	8.4	.6	.484	11.98	33.2	8.30		9.5	0.48	25.0	123	154	12.0	140	398			-.062	
50 / 45	520.0	7.7	.7	.499	12.35	31.5	7.87		8.0	0.42	29.4	122	152	11.5	140	398			-.062	
53 / 50	519.5	7.2	.5	.513	12.69	30.9	7.72		8.4	0.43	29.5	121	153	10.5	137	402			-.061	
																(459)			(.717)	Flow
60 / 55	518.9	6.6	.6	.518	12.81	30.4	7.60		6.2	0.32	40.0	121	153	10.5	137	405			-.062	SO2 1.5
65 / 1400	518.2	5.9	.7	.542	13.41	28.1	7.02		4.7	0.25	53.6	121	153	10.5	138	410			-.062	CO2 1.5
70 / 05	517.6	5.3	.6	.529	13.09	28.9	7.22		4.3	0.21	62.3	120	153	10.5	138	410			-.062	O2 1.5
75 / 10	517.1	4.8	.5	.519	12.84	29.7	7.42		3.2	0.16	80.2	118	152	9.5	135	409			-.062	CO 1.5
80 / 15	516.6	4.3	.5	.518	12.81	29.2	7.30		3.6	0.19	67.4	118	153	9.5	135	412			-.062	
85 / 20	516.1	3.8	.5	.467	11.56	33.8	8.45		4.9	0.25	46.2	115	150	8.8	133	392			-.060	
90 / 25	515.7	3.4	.4	.442	10.94	36.3	9.07		4.7	0.25	43.8	113	146	8.5	133	377			-.057	
95 / 30	515.4	3.1	.3	.410	10.15	39.3	9.82		7.7	0.40	26.4	110	142	7.5	129	363			-.055	
100 / 35	515.1	2.8	.3	.332	8.23	46.1	11.52		12.2	0.62	13.3	105	138	6.4	124	339			-.053	
105 / 40	514.9	2.6	.2	.306	7.59	48.3	12.07		13.4	0.68	11.2	101	133	5.5	121	321			-.049	
110 / 45	514.7	2.4	.2	.292	7.24	49.2	12.29	OUT BAL.	15.4	0.78	(9.3)	99	130	5.3	119	306			-.047	
115 / 50	514.6	2.3	.1	.273	6.77	50.6	12.64		95.0	1.00	6.8	96	127	4.6	115	295			-.045	
																(4439)			(.676)	
																9030			1.393	

BURN[illegible]TE AND FLUE GAS DATA
WOODSTOVE DATA SHEET #12
WST2-Form 14 Rev 1/88
END WT.: 512.3 lbs.

Unit: KUMA WOOD CLASSIC Date: 9/16/99
Run: EPA 5 Technician(s): ATM, RLS, J.P.
Page: 2 of 3

Minute / Time	Scale Wt	lbs left	Burn Rate	1 CO_2 v.	1 CO_2 %CO_2	2 O_2 v.	2 O_2 %O_2	Tel	3 CO v.	3 CO %CO	Bal	T/C(1)T/C(2) Wet Bulb	Dry Bulb	% H_2O	T/C(3) Calc W/B	Stack	4 SO_2 v.	SO_2 PPM	Static Press.	Comments
120/455	514.5	2.2	.1	.254	6.31	51.7	12.92		22.5	1.12	5.6	93	124	4.1	114	288			-.044	Flow
125/600	514.4	2.1	.1	.252	6.26	52.1	13.02		21.8	1.10	5.7	91	122	3.9	112	281			-.042	SO_2 1.5
130/05	514.3	2.0	.1	.252	6.26	52.4	13.09		20.6	1.02	6.1	89	121	3.5	111	275			-.041	~~CO_2~~ 1.5
135/10	514.2	1.9	.1	.252	6.26	52.4	13.09		21.3	1.07	5.8	88	120	3.4	110	270			-.040	~~O_2~~ 1.5
140/15	514.1	1.8	.1	.247	6.13	53.0	13.24		21.7	1.09	5.6	87	119	3.2	110	267			-.040	~~CO~~ 1.5
145/20	514.0	1.7	.1	.245	6.08	53.3	13.31		22.8	1.14	5.3	87	118	3.2	110	264			-.040	
150/25	513.9	1.6	.1	.214	5.32	55.8	13.94		27.9	1.40	3.8	86	118	3.1	109	261			-.039	
155/30	513.8	1.5	.1	.213	5.30	55.9	13.96		27.5	1.39	3.8	86	118	3.1	109	257			-.038	
160/35	513.8	1.5	0	.211	5.25	56.0	13.99		27.9	1.40	3.7	85	117	3.0	108	254			-.037	
165/40	513.7	1.4	.1	.200	4.98	57.3	14.31		27.5	1.39	3.6	85	116	3.0	107	250			-.036	
170/45	513.6	1.3	.1	.193	4.80	58.0	14.49		28.6	1.43	3.4	85	116	3.0	107	247			-.036	
175/50	513.5	1.2	.1	.181	4.51	59.0	14.74		28.9	1.43	3.2	85	115	3.0	106	242			-.036	
																3156 ✓			.469	Flow
180/55	513.5	1.2	0	.183	4.56	59.2	14.79		28.5	1.41	3.2	84	113	2.9	105	239			-.036	SO_2 1.5
185/600	513.4	1.1	.1	.188	4.68	58.7	14.66		27.6	1.39	3.4	84	112	2.9	104	236			-.035	~~CO_2~~ 1.5
190/05	513.3	1.0	.1	.193	4.80	58.2	14.54		27.1	1.36	3.5	83	112	2.8	103	234			-.035	~~O_2~~ 1.5
195/10	513.3	1.0	0	.194	4.83	58.1	14.51		26.7	1.33	3.6	83	111	2.8	103	232			-.034	~~CO~~ 1.5
200/15	513.2	.9	.1	.199	4.95	57.8	14.44		25.7	1.29	3.8	83	111	2.8	103	230			-.034	
205/20	513.1	.8	.1	.198	4.93	57.9	14.46		27.1	1.35	3.6	83	111	2.8	103	228			-.034	
210/25	513.1	.8	0	.203	5.05	57.5	14.36		27.2	1.36	3.7	82	111	2.7	103	226			-.033	
215/30	513.0	.7	.1	.206	5.12	57.2	14.29		26.4	1.32	3.9	83	111	2.8	103	225			-.032	
220/35	512.9	.6	.1	.206	5.12	57.4	14.34		25.1	1.27	4.0	83	112	2.8	102	223			-.032	
225/40	512.9	.6	0	.201	5.00	58.0	14.49		26.7	1.33	3.8	82	112	2.7	102	222			-.032	
230/45	512.8	.5	.1	.200	4.98	58.1	14.51		26.0	1.30	3.8	82	111	2.7	102	221			-.032	
235/50	512.8	.5	0	.202	5.02	58.0	14.49		24.7	1.23	4.1	83	110	2.9	102	220			-.032	
																2736 ✓			.401	
																5892			.870	

BURN RATE AND FLUE GAS DATA
WOOD STOVE DATA SHEET #12
WST2 Form 14 Rev 1/88
ENO WT. 512.3 lbs

Unit: KUMA WOOD CLASSIC Date: 9/16/99
Run: EPA 5 Technician(s): A.T.M, D, RLS, J.P.
Page: 3 of 3

Minute / Time	Scale Wt	lbs left	Burn Rate	1 CO_2 v.	1 CO_2 %CO_2	2 O_2 v.	2 O_2 %O_2	Tel	3 CO v.	3 CO %CO	T/C(1) Bal	T/C(2) Wet Bulb	T/C(2) Dry Bulb	% H_2O	T/C(3) Calc W/B	T/C(3) Stack	4 SO_2 v.	4 SO_2 PPM	Static Press.	Comments
240 / 1655	512.7	.4	.1	.200	4.98	58.1	14.51		25.3	1.28	3.9	82	109	2.8	102	220			-.032	Flow
245 / 1700	512.6	.3	.1	.204	5.07	58.0	14.49		25.0	1.26	4.0	82	108	2.8	102	219			-.031	SO_2 1.5
250 / 05	512.6	.3	0	.201	5.00	58.1	14.51		25.3	1.29	3.9	81	108	2.7	102	217			-.031	CO_2 1.5
255 / 10	512.5	.2	.1	.200	4.98	58.2	14.54		25.1	1.27	3.9	81	108	2.7	102	216			-.031	O_2 1.5
260 / 15	512.5	.2	0	.193	4.80	59.2	14.79		23.4	1.18	4.1	82	108	2.8	102	216			-.030	CO 1.5
265 / 20	512.4	.1	.1	.193	4.80	59.1	14.76		24.0	1.20	4.0	82	109	2.8	102	215			-.030	
270 / 25	512.3	0	.1	.188	4.68	59.6	14.89		23.5	1.17	4.0	82	109	2.8	102	215			-.030	
275 / 30																1678 ✓			.215	
280 / 35																				
285 / 40														55		16,440 ✓			2.478	
290 / 45																				
295 / 50																299 ✓			.045	
300 / 55																				Flow
305 / 1800																				SO_2 1.5
310 / 05																				CO_2 1.5
315 / 10																				O_2 1.5
320 / 15																				CO 1.5
325 / 20																				
330 / 25																				
335 / 30																				
340																				
345																				
350																				
355																				

Pre Burn Tear Wt. 5.5 lbs. Tear Wt. lbs. Tear Wt. Range 512.7 – 512.1 lbs.

PRE BURN DATA RECORD SHEET #13
WST2-Form16

BARO. PRESSURE 28.52 " Hg

Unit: Kuma Wood Check Date: 9/16/ 199.
Run: EPA 5 Technician(s): ATM KHC JP
Page: 1 of 1

Hot Box On

Minute Time	Scale Weight	Burn Rate	T/C#-3 Stack	4 Stove Top	5 Left Side	6 Back	7 Right Side	8 Bottom	9 Firebox	10 2nd Burn Catalytic	11 Room Temp	Static	Comments (13/16" FROM SIDE)	
1231 0 1055	518.2	0	657	921	591	462	584	531	955	1594	73	-.088	Primary Air Set at 7/16" OPEN	
1158 5 1100	517.3	.9	501	806	599	455	589	530	939	1372	70	-.079	Secondary Air Set at N/A	
1160 10 05	516.6	.7	466	744	600	451	588	528	922	1358	72	-.075	Fan: OFF	
1315 15 10	516.0	.6	454	741	597	446	584	522	928	1415	71	-.073	TUNNEL ON AT: 1057	
1262 20 15	515.4	.6	449	740	599	441	579	513	930	1454	70	-.071	Buckets IN	
1277 25 20	514.8	.6	438	733	600	439	579	504	943	1367	71	-.070	ANALYZERS SPANNED	
1313 30 25	514.3	.5	401	664	600	432	583	493	1147	1235	72	-.064	Pumps turned on at: 1125	
1130 35 30	514.1	.2	387	602	595	431	581	486	1043	1164	72	-.062	RAKE GAINS	ΔT
1086 40 35	513.9	.2	368	564	588	425	572	480	992	1128	71	-.059		525.8
994 45 40	513.8	.1	349	524	578	416	559	471	976	1150	73	-.055	Check WB/DB: 80/93	509.6
953 50 45	513.7	.1	331	486	563	407	550	464	956	1090	73	-.052		494.0
905 55 50	513.6	.1	317	459	551	399	541	458	935	987	73	-.050		481.6
													Probe IN TUNNEL	
891 60 55	513.5	.1	307	437	541	392	531	454	919	966	73	-.049		471.0
879 65 1200	513.4	.1	298	420	530	385	522	451	911	964	74	-.047		461.6
875 70 05	513.3	.1	296	409	520	379	512	449	908	985	74	-.046		453.8
867 75 10	513.2	.1	289	402	507	373	512	447	900	953	73	-.044		448.2
859 80 15	513.2	0	286	394	501	369	503	445	887	943	74	-.043		442.4
856 85 20	513.1	.1	281	391	495	364	498	444	882	952	75	-.043		438.4
875 90 25	513.0	.1	277	387	488	361	494	443	882	980	76	-.042		434.6
869 95 30	512.9	.1	275	383	483	358	490	442	880	941	76	-.041		431.2
853 100 35	512.8	.1	272	381	484	356	486	442	877	915	76	-.041		429.8
859 105 40	512.6	.2	268	379	484	354	482	441	871	917	77	-.040		428.0
876 110 45	512.5	.1	265	376	483	352	479	441	864	936	77	-.040		426.2
848 115 50	512.4	.1	264	369	482	351	476	440	854	922	78	-.040		423.6
840 120 55	512.3	.1	262	362	480	349	472	439	848	910	76	-.039	✓	420.4
125 1300														

TEMPERATURES
RECORD SHEET #14
WST2-Form14 Rev7/96

Unit: Kuma Wood Classic Date: 9/16/19
Run: EPA 5 Technician(s): ATM, JP, DLS
Page: 1 of 3 Rear 2nd

T/C#	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Minute / Time	Stove Top	Left Side	Back	Right Side	Bottom	Firebox	2nd Burn [redacted]	Room Temp	Tunnel	C. Gas Box	Impinger Out	5G-1 Filter	5G-1 Condenser	[redacted]	HOT BOX
0 / 1255	362	480	349	472	439	848	910	76	92	249	39	78	48	840	249
5 / 1300	374	477	346	465	440	731	1471	75	113	248	39	80	36	1049	248
10 / 05	477	482	335	462	440	689	1368	74	104	250	39	83	36	820	248
15 / 10	478	476	326	457	439	701	1375	74	100	250	39	85	36	1034	249
20 / 15	496	473	319	444	437	729	1429	74	101	250	39	85	36	960	249
25 / 20	534	475	314	442	434	758	1427	74	102	250	39	85	36	992	249
30 / 25	571	481	311	446	431	770	1507	75	103	250	39	86	36	994	250
35 / 30	608	490	308	453	427	795	1620	75	104	250	39	86	36	1044	250
40 / 35	631	500	308	462	424	832	1533	74	106	250	39	87	36	1081	250
45 / 40	610	511	312	472	420	852	1434	75	105	250	39	88	36	1124	250
50 / 45	595	519	316	481	417	905	1368	76	105	250	39	88	36	1117	250
55 / 50	594	526	320	487	415	939	1330	76	106	250	39	88	36	1110	250
	6330	5890	3864	5537	6163	9549	16,674	898							
60 / 55	600	533	323	495	414	988	1331	76	107	250	39	88	36	1106	250
65 / 1400	617	542	328	502	413	1006	1348	75	107	250	39	88	37	1116	250
70 / 05	624	550	332	509	412	996	1340	76	107	250	39	88	37	1136	250
75 / 10	623	555	337	516	411	993	1176	77	107	249	39	88	37	1171	250
80 / 15	644	558	342	523	411	1005	1192	77	108	249	39	88	37	1210	250
85 / 20	630	561	348	531	412	995	1210	77	107	250	39	88	37	1205	250
90 / 25	612	563	355	535	413	980	1184	76	106	250	39	88	37	1228	250
95 / 30	592	563	360	536	415	975	1258	76	105	250	39	88	37	1274	250
100 / 35	642	561	364	535	416	964	1147	76	102	249	38	88	37	1196	250
105 / 40	502	558	370	529	418	942	1112	77	101	250	38	88	37	1147	249
110 / 45	475	552	374	520	419	928	1093	77	100	250	37	88	37	1127	249
116 / 50	449	545	375	512	420	907	990	78	100	250	37	88	37	1131	249
	6910	6641	4208	6243	4974	11,679	14,381	918							
	13,340	12,531	8072	11,780	10,137	21,228	31,053	1816							

TEMPERATURES
RECORD SHEET #14
WST2-Form14 Rev7/96

Unit: KUMA Wood Classic Date: 9/16/99
Run: EPA5 Technician(s): ATH, RLS, J.P.
Page: 2 of 3

T/C#	4	5	6	7	8	9	10	11	12	13	14	15	16	17 REAR 2nd	18
Minute / Time	Stove Top	Left Side	Back	Right Side	Bottom	Firebox	2nd Burn ~~Catalytic~~	Room Temp	Tunnel	C. Gas Box	Impinger Out	5G-1 Filter	5G-1 Condenser	~~Con~~ das	Hot Box
120 / 1455	434	537	373	506	422	892	967	76	99	250	37	88	37	1096	249
125 / 1500	418	528	369	500	424	884	958	77	99	250	37	88	37	1060	249
130 / 05	407	520	365	494	426	869	952	77	98	250	37	88	37	1056	249
135 / 10	398	512	363	490	427	857	930	77	98	250	37	88	37	1039	249
140 / 15	390	505	361	486	429	845	905	77	98	250	37	88	37	1030	249
145 / 20	382	498	360	482	430	836	892	78	97	249	38	89	37	923	249
150 / 25	375	491	356	478	431	829	871	77	96	249	38	89	37	892	249
155 / 30	370	483	352	471	431	820	857	78	97	250	38	89	37	875	249
160 / 35	364	477	348	465	431	808	837	77	96	250	38	89	37	871	250
165 / 40	356	470	344	459	430	798	816	77	96	250	38	89	38	835	250
170 / 45	351	464	341	452	429	785	801	77	96	250	38	89	38	820	250
175 / 50	344	458	338	445	426	770	782	77	95	250	38	89	37	808	250
	4589	5943	4270	5728	6736	9,993	10,568	975							
180 / 55	337	451	335	438	423	756	769	77	94	250	38	88	37	807	250
185 / 1600	331	444	333	433	420	747	762	77	93	250	38	88	38	814	250
190 / 05	326	439	331	428	417	742	758	77	92	249	38	87	38	811	250
195 / 10	322	433	330	424	414	740	747	77	92	250	38	87	38	839	250
200 / 15	318	429	329	421	412	742	744	77	91	250	39	87	38	841	251
205 / 20	317	425	329	418	409	743	742	77	89	250	39	86	38	851	250
210 / 25	317	422	330	416	406	742	739	77	90	250	39	86	38	860	249
215 / 30	314	419	330	414	404	739	736	77	91	250	39	86	38	868	249
220 / 35	312	416	330	404	402	736	727	78	91	250	39	86	38	890	250
225 / 40	309	414	331	412	400	718	717	78	90	250	39	86	38	870	249
230 / 45	308	410	331	411	398	713	713	78	91	250	39	86	38	857	249
235 / 50	306	407	331	410	397	713	708	76	91	250	39	86	38	865	249
	3817	5109	3970	6029	4902	8831	8862	926							
	8406	14,052	8240	10,757	10,038	18,824	19,430	1851							

TEMPERATURES
RECORD SHEET #14
WST2-Form14 Rev7/96

t: KUHA Wood Classic Date: 9/16/99
: EPA 5 Technician(s): ATM, JS, J.P.
Page: 3 of 3

T/C#	4	5	6	7	8	9	10	11	12	13	14	15	16	17 REAR DUP	18
Minute / Time	Stove Top	Left Side	Back	Right Side	Bottom	Firebox	2nd Burn ~~Catalytic~~	Room Temp	Tunnel	C. Gas Box	Impinger Out	5G-1 Filter	5G-1 Condenser	~~Con~~ dor	HOT BOX
240 1655	303	404	331	408	395	714	705	75	90	250	39	85	38	875	250
245 1700	301	402	331	406	394	716	703	75	89	250	40	85	38	878	249
250 05	299	400	332	404	392	715	701	76	89	250	40	84	38	890	249
255 10	298	399	332	403	391	713	699	77	90	250	40	84	38	902	249
260 15	298	398	333	403	389	702	691	77	91	250	40	84	38	875	249
265 20	296	397	332	402	388	699	688	77	91	250	40	85	38	868	249
270 25	295	395	331	400	387	697	683	77	91	250	40	85	38	867	250
275 30	2090	2795	2327	2826	2736	4956	4870	534							
280 35															
285 40	~~23,836~~ 23,736	~~26,398~~ 26,378	18,134	25,363	22,911	45,008	55,353	4201	557	AVG. STOVE TEMP. CHANGE			START:	420.4	✓
290 45													STOP:	361.6	✓
295 50	433	480	339	461	417	818	1006	76					ΔT:	-58.8	✓
	432														
300 55															
305 1800															
310 05															
315 10															
320 15															
325 20															
330 25															
335 30															
340															
345															
350															
355															

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-1

Site: Myren Consulting, Woodinville, WA Date: 9/16/99 Analyte: CO_2

Source: Kuma Wood Classic Run #: EPA 5

Zero Cyl #: 719 430 Conc. 00.0 % CO_2 Cyl Press: 1850 psi

Certified by: Oxarc Date: 4/1/99

Span Cyl #: 350 - 794 Conc. 12.5 % CO_2 Cyl Press: 1310 psi

Certified by: Oxarc Date: 3/26/99

Analyzer: Make: Horiba Model: PIR-2000 SN: 607024

Range: 0 - 25.0% CO_2 Analyzer Output: 0 - 1.0 v.

Flow: 1.5 SCFH Measured by: Rotameter: X Flowmeter:

EPA Span Value = 25.0% CO_2

EPA Control Limits = ± 2.5% of 25.0% CO_2 = ± 0.625% CO_2

Pre Run Audit: By: RLS Time: 1120 Temp: 71 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	.000	00.0	00.0	.000	.0446	.0446	+0.18
Span	50.0	.500	12.5	49.4	.490	12.1246	-.3754	-3.00

Comments:

Post Run Audit: By: RLS Time: 1735 / Temp: 76 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	.000	00.0	00.0	.000	.0446	.0446	+0.18
Span	50.0	.500	12.5	49.5	.490	12.1246	-.3754	-3.00

Comments:

± Conc. Difference = Act % - Exp (Std) %

Zero % Differece = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}} \times 100$

Span % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Exp \% (ppm)}} \times 100$

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-2

Site: Myren Consulting, Woodinville, WA Date: 9/16/99 Analyte: O_2

Source: Kuma Wood Classic Run #: EPA 5

Zero Cyl #: 719 430 Conc. 00.0 % O_2 Cyl Press: 1850 psi

Certified by: Oxarc Date: 4/1/99

Span Cyl #: 250-794 Conc. 12.5 % O_2 Cyl Press: 1310 psi

Certified by: Oxarc Date: 3/26/99

Analyzer: Make: Taylor Model: OA 137 SN: 137/4772

Range: 0 - 25.0% O_2 Analyzer Output: 0 - 100 mv.

Flow: 1.5 SCFH Measured by: Rotameter: X Flowmeter:

EPA Span Value = 25.0% O_2
EPA Control Limits = + 2.5% of 25.0% O_2 = + 0.625% O_2

Pre Run Audit: By: RLS Time: 1120 Temp: 71 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	00.1	00.0	.0050	+.0050	+0.02
Span	12.5	50.0	12.5	12.5	49.4	12.3409	-0.1591	-1.27

Comments:

Post Run Audit: By: RLS Time: 1735 Temp.: 76 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	00.1	00.0	.0050	+.0050	+0.02
Span	12.5	50.0	12.5	12.5	49.4	12.3409	-0.1591	-1.27

Comments:

± Conc. Difference = Act % - Exp (Std) %

Zero % Differece = $\frac{\text{Act \% (ppm)} - \text{Exp \% (ppm)}}{\text{Full Scale Value}} \times 100$

Span % Difference = $\frac{\text{Act \% (ppm)} - \text{Exp \% (ppm)}}{\text{Exp \% (ppm)}} \times 100$

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-3

Site: Myren Consulting, Woodinville, WA Date: 9/16/99 Analyte: CO

Source: Kuma Wood Classic Run #: EPA 5

Zero Cyl #: 719 430 Conc. 00.0 % CO Cyl Press: 1850 psi

Certified by: Oxarc Date: 4/1/99

Span Cyl #: 250-794 Conc. 2.5 % CO Cyl Press: 1310 psi

Certified by: Oxarc Date: 3/26/99

Analyzer: Make: Infra Red Model: 702 D SN: 113

Range: 0 - 10.0% CO Analyzer Output: 0 - 100 mv.

Flow: 1.5 SCFH Measured by: Rotameter: X Flowmeter:

EPA Span Value = 5.0% CO
EPA Control Limits = +2.5% of 5.0% CO = + 0.125% CO

Pre Run Audit: By: RLS Time: 1120 Temp: 71 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	0.00	00.0	.0093	-.0093	-0.19
Span	2.50	50.0	2.50	2.50	50.0	2.4914	-.0086	-0.34

Comments:

Post Run Audit: By: RLS Time: 1735 Temp.: 71 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	0.00	00.1	.0043	-.0043	-0.09
Span	2.50	50.0	2.50	2.45	48.9	2.4364	-.0636	-2.54

Comments:

± Conc. Difference = Act % - Exp (Std) %

Zero % Differece = $\frac{\text{Act \% (ppm)} - \text{Exp \% (ppm)}}{\text{Full Scale Value}} \times 100$

Span % Difference = $\frac{\text{Act \% (ppm)} - \text{Exp \% (ppm)}}{\text{Exp \% (ppm)}} \times 100$

Unit: Kuma Wood Chair
Run: EPA 5
Date: 9/16/199
Technicians: ATM / RLS, J.A.
WST6-Form3-Rev11/89

QUALITY CHECKS
WOODSTOVE DATA SHEET #16

Ambient = Tr: _____ °F T/C#30: _____ °F

Thermocouple Check (at ambient): T/C#1: 65 °F; T/C#2: 65 °F;

T/C #3: 66 °F; T/C #4: 66 °F; T/C #5: 67 °F;

T/C #6: 67 °F; T/C #7: 67 °F; T/C #8: 67 °F;

T/C #9: 67 °F; T/C #10: 67 °F; T/C #11: 67 °F;

T/C #12: 66 °F; T/C #13: 66 °F; T/C #14: 66 °F;

T/C #15: 66 °F; T/C #16: 66 °F; T/C #17: 67 °F;

T/C #18: 66 °F; T/C #19: _____ °F; T/C #20: _____ °F;

T/C #21: _____ °F; T/C #22: _____ °F; T/C #23: _____ °F;

T/C #24: _____ °F; T/C #25: _____ °F; T/C #26: _____ °F;

Comments: _____

Thermocouple Readout: Pretest Zero/Span Check and Calibration:

Zero (0°F): 001 °F Adj to: 000 °F Post Test Check Zero (0°F): 001 °F % Difference +0.05%

Span (2000°F): 1999 °F Adj to: 2000 °F Span (2000°F): 2000 °F 0

(Allowable % Difference = 1.5%. Use formulas on Woodstove Data Sheet #15 to calculate % Difference)

Thermocouple Readout Pretest Linearity Check

0°F = 000 °F; 200°F = 200 °F; 400°F = 399 °F;

600°F = 599 °F; 800°F = 800 °F; 1000°F = 1000 °F;

1200°F= 1200 °F; 1400°F = 1400 °F; 1600°F = 1599 °F

1800°F= 1800 °F; 2000°F = 2000 °F

Combustion Gas (CO_2,O_2,CO) Train Leak Check: Pre ✓ Post ✓

Draft (Static) Guage Zero Check: Pre ✓ Post ✓

Scale Check Pre (Wt, #'s): 570.8 - 575.8 5.0 lbs. OK (RLS)

Post (Wt, #'s): 572.3 - 577.3 5.0 lbs. OK (RLS)

Stack cleaned prior to the run: Yes _____ No ✓

Tunnel cleaned prior to the run: Yes _____ No ✓

DILUTION TUNNEL CALCULATIONS — MYREN CONSULTING CERTIFICATION TEST DATA

3/31/96

File Name:	KumaEPA3
Stove Manufacturer:	Kuma
Model Number:	Wood Classic
Lab Name:	MYREN
Test Date:	9\14\99
Run Number:	EPA 3
Meter Box Y Factor:	1.0151
Barometric pressure (in):	28.6067
Gas meter temp (ave):	92
delta H(avg):	0.900
Gas meter initial reading:	732.504
Gas meter final reading:	877.782
Front catch (acetone) mg:	6.1
first filter catch (mg):	9.8
second filter catch (mg):	0.2
tunnel flow (ave cfm):	147.784
Emission Rate(g/hr):	1.073
Emission Rate(M5H) :	1.930
vs/VmTs:	0.0115
vs ave:	873.272
Tunnel average temp (°f):	101.926
Test time(min):	260
Fuel Load(lb. wet):	14.6
Wood moisture(%wet):	17.582
Burn rate(dry kg/hr):	1.260
Samp vol(scf):	134.935
front filter number	934
back filter number	933
acetone beaker number	30
PRELIMINARY RESULTS	
FINAL RESULTS	AUDITED
DATA SUMMARY	
MODEL :	Wood Classic
RUN:	EPA 3
DATE:	9\14\99
DBR:	1.260
GPH UNADJ	1.073
ADJ	1.929961393

RUN TIME (min)	PITOT DELTAP (- INCH H20)	TNL TEMP (°F)	GAS METER RDG (ft3)	GAS METER TEMP (°F)	GAS METER DELTA H (in.H2O)	TUNNEL VELOCIT (ft/min)	PROP RATE (%)	dDGM vol std (ft3)
0	0.043	101	732.504	81	0.900	872.58		
10	0.043	118	738.071	82	0.900	885.70	104.6	5.274
20	0.043	118	743.655	84	0.900	885.70	103.0	5.270
30	0.043	122	749.216	86	0.900	888.76	102.9	5.229
40	0.043	118	754.771	88	0.900	885.70	101.4	5.205
50	0.043	113	760.347	89	0.900	881.86	101.0	5.215
60	0.043	111	765.919	90	0.900	880.32	100.9	5.201
70	0.043	107	771.507	91	0.900	877.23	100.4	5.207
80	0.043	105	777.113	91	0.900	875.68	100.7	5.224
90	0.043	103	782.703	92	0.900	874.13	100.1	5.199
100	0.043	101	788.289	93	0.900	872.58	99.7	5.186
110	0.043	99	793.869	93	0.900	871.02	99.4	5.181
120	0.043	98	799.465	94	0.900	870.24	99.7	5.196
130	0.043	98	805.050	94	0.900	870.24	99.4	5.176
140	0.043	97	810.645	94	0.900	869.46	99.4	5.185
150	0.043	97	816.238	94	0.900	869.46	99.4	5.183
160	0.043	96	821.835	95	0.900	868.68	99.1	5.178
170	0.043	96	827.425	95	0.900	868.68	99.1	5.171
180	0.043	96	833.024	96	0.900	868.68	99.1	5.170
190	0.043	95	838.615	96	0.900	867.90	98.8	5.163
200	0.043	95	844.220	96	0.900	867.90	99.1	5.176
210	0.043	95	849.900	96	0.900	867.90	100.4	5.245
220	0.043	95	855.390	97	0.900	867.90	96.9	5.061
230	0.043	95	860.950	97	0.900	867.90	98.1	5.125
240	0.043	95	866.580	97	0.900	867.90	99.4	5.190
250	0.043	94	872.175	97	0.900	867.12	98.6	5.157
260	0.043	94	877.782	97	0.900	867.12	98.9	5.168
270						0.00	0.0	0.000
280						0.00	0.0	0.000
290						0.00	0.0	0.000
300						0.00	0.0	0.000
310						0.00	0.0	0.000
320						0.00	0.0	0.000
330						0.00	0.0	0.000
340						0.00	0.0	0.000
350						0.00	0.0	0.000

METHOD 5G-1 PARTICULATE SAMPLING DATA Kuma LAB-

DATE 1/14/1999 PAGE 1 OF 2 MODEL # Wood Classic RUN # EPA 3

METER BOX # 511-M METER Y 1.0151 FILTER # (F) 934 (R) 933

PRE TEST LEAK RATE = .000 CFM @ -16.0 IN. HG, 1745/1745 FILTER SIZE: 110 mm

POST TEST LEAK RATE = .000 CFM @ -15.75 IN. HG .018/.018 PROBE LENGTH 24" glass

Mag

TIME		METER READING CU.FT.	PITOT dp	TNL TEMP. (°F)	METER TEMP. (°F)	GAS METER dh	VAC IN. Hg
CLOCK	ELAPSED						
1215	00	732.504	.043	101	81	.90	0
25	10	738.071	.043	118	87	.90	0
35	20	743.655	.043	118	84	.90	0
45	30	749.216	.043	122	86	.90	0
55	40	754.771	.043	118	88	.90	0
1305	50	760.347	.043	113	89	.90	0
15	60	765.919	.043	111	90	.90	0
25	70	771.507	.043	107	91	.90	0
35	80	777.113	.043	105	91	.90	0
45	90	782.703	.043	103	92	.90	0
55	00	788.299	.043	101	93	.90	0
1405	10	793.869	.043	99	93	.90	0
15	20	799.465	.043	98	94	.90	0
25	30	805.050	.043	98	94	.90	0
35	40	810.645	.043	97	94	.90	0
45	50	816.238	.043	97	94	.90	0
55	60	821.835	.043	96	95	.90	0
1505	70	827.425	.043	96	95	.90	0
15	80	833.024	.043	96	96	.90	0
25	90	838.615	.043	95	96	.90	0

VELOCITY TRAVERSE

POINT	LOCATION	Δp	TEMP
N-1	0.5"	.032	105
2	1.5"	.037	106
3	4.5"	.039	106
4	5.5"	.038	105
W-1	0.5"	.036	106
2	1.5"	.042	106
3	4.5"	.041	106
4	5.5"	.040	106
	Avg.	.038	105.750

Pilot Leak Check Pre ____ Post ✓

Cp = 0.99

N
1
2
W 1 2 (3*4)
3
4

*=point of Avg. delta p

$Qs = \left(\sqrt{\frac{(\Delta P \times BP)}{T(°R)}}\right) \times 3167.2 =$

138.961 cfm

BP = ~~START~~ 28.66 in Hg

60	28.64
120	28.61
180	28.59
240	28.58
960	28.56 ✓
X =	28.60067

10.5
1.1 2.3

METHOD 5G — PARTICULATE SAMPLING DATA — LAB-

DATE 9/14/99 PAGE 2 OF 2 MODEL # KUMA WOOD CLASSIC RUN # EPA 3

METER BOX # 571 M METER Y 1.0157 FILTER # (F)934 (R)933

PRE TEST LEAK RATE = .000 CFM @ -16.0 IN. HG .1745/.1745 FILTER SIZE: 110 MM

POST TEST LEAK RATE = .000 CFM @ -15.75 IN. HG .018/.018 PROBE LENGTH 24" 6 CLASS

TIME		METER READING CU.FT.	PITOT dp	TNL TEMP. (°F)	METER TEMP. (°F)	GAS METER dh	VAC IN. Hg
CLOCK	ELAPSED						
1535	00	844.220	-.043	95	96	.90	0
45	10	849.900	-.043	95	96	.90	0
55	20	855.390	-.043	95	97	.90	0
1605	30	860.950	-.043	95	97	.90	0
15	40	866.580	-.043	95	97	.90	0
25	50	872.175	-.043	94	97	.90	0
35	60	877.782	-.043	94	97	.90	0
.	70	(145.278)					
	80						
	90						
	00						
	10						
	20						
	30						
	40						
	50						
	60						
	70						
	80						
	90						

VELOCITY TRAVERSE

POINT	LOCATION	ΔP	TEMP
N-1	0.5"	-.032	105
2	1.5"	-.037	106
3	4.5"	-.039	106
4	5.5"	-.038	105
W-1	0.5"	-.036	106
2	1.5"	-.042	106
3	4.5"	-.041	106
4	5.5"	-.040	106
	Avg.	-.038	105.75

Pilot Leak Check Pre ✓ Post ✓

Cp = 0.99

N
1
2
W 1 2 3*
3
4

*=point of Avg. delta p

$Qs = \left(\sqrt{\frac{\Delta P \times BP}{T(°R)}}\right) \times 3167.2 =$

138.961 cfm

BP = Show 29.66 in Hg

60 28.64
120 28.61
180 28.59
240 28.58
260 28.56

$\bar{X}$ = 28.6067

WOODSTOVE DATA SHEET #4-1: INITIAL FILTER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date 1/9/99 Time 1445 By ATM Front Half ✓ Back Half ✓

Manufacturer: Schleicher & Schuell Size: 11cm Lot.No.: Z8961 Grade: #25 Glass
Order No: 06220

	Filter #	First Wt	Date	Time	By	Second Wt	Date	Time	By	Third Wt	Date	Time	By
	926	.7740	3/6/99	1140	TM	.7739	3/15/99	1652	ATM				
	927	.7938		1141	TM	.7938		1651	ATM				
	928	.7985		1142	TM	.7985		1650	ATM				
	929	.7909		1143	TM	.7912		1649	ATM				
	930	.7948		1144	TM	.7950		1648	ATM				
	931	.8041		1145	TM	.8042		1647	ATM				
	932	.7917		1146	TM	.7918		1646	ATM				
	933	.8047		1147	TM	.8048		1645	ATM	✓	✓		
*	934	.7981		1148	TM	.7918		1644	ATM	.7917	3/16/99	2130	JM
	935	.7861		1149	TM	.7861		1643	ATM				
	936	.7827		1150	TM	.7828		1643	ATM				
	937	.7935		1151	TM	.7933		1642	ATM				
	938	.8086		1152	TM	.8084		1641	ATM				
	939	.8060		1153	TM	.8058		1640	ATM				
	940	.8151		1154	TM	.8151		1639	ATM				
	941	.8252		1155	TM	.8249		1638	ATM				
	942	.7982		1156	TM	.7983		1637	ATM				
	943	.7822		1157	TM	.7822		1636	ATM				
*	944	.7938		1158	TM	.7968		1635	ATM	.7968	3/16/99	2131	JM
	945	.7944		1159	TM	.7943		1635	ATM				
	946	.7852		1200	TM	.7850		1634	ATM				
	947	.7731		1201	TM	.7735		1633	ATM				
	948	.7936		1202	TM	.7940		1632	ATM				
	949	.7838		1203	TM	.7837		1631	ATM				
	950	.8040	✓	1204	TM	.8038		1630	ATM				

Checked by JM Date: 3/16/99 Time 2133

QA REWEIGH

Filter #	WT	Date	Time	By
929	.7912	3/16/99	2136	JM
941	.8248	3/16/99	2134	JM
949	.7837	3/16/99	2133	JM

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
64	79	43	3/6/99	1135	ATM
66	81	45	3/15/99	1622	ATM
65	82	39	3/16/99	2035	ATM

Post Test Weighing Session Scale Check

1st	2nd	3rd	QC
0.0000	0.0000	0.0000	0.0001
1.0000	1.0000	1.0000	0.9999

WOODSTOVE DATA SHEET #4-2:
INITIAL BEAKER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date: 8/20/99 Time: 1500 By: A.T.Myren

Beaker #	First Wt	Date	Time	By	Second Wt	Date	Time	By	Third Wt	Date	Time	By
Glass 1	65.7841	8/27	2059	JM	65.7835	8/30/99	1211	ATM				
2	66.1509	8/27	2118	JM	66.1514		1204	ATM				
3	67.8582		2116	JM	67.8579		1207	ATM				
4	67.5890		2108	JM	67.5891		1210	ATM				
6	67.4270		2119	JM	67.4274		1213	ATM				
7	65.5444		2105	JM	65.5446		1220	ATM				
8	66.0219		2121	JM	66.0218		1205	ATM				
9	66.9297		2120	JM	66.9296		1215	ATM				
10	66.0906		2114	JM	66.0902		1209	ATM				
11	65.7072		2112	JM	65.7020		1217	ATM	65.7028	9/8/99	1717	JM
13	57.8946	↓	2110	JM	57.8948	↓	1218	ATM				
									65.7021	9/11	1232	ATM
									65.7022	9/13	1934	JM
SS 20	73.3159	8/27	2125	JM	73.3160	8/31/99	1320	ATM				
21	71.0002	8/27	2126	JM	71.0003	↓	1325	ATM				
22	71.8322	9/11/99	1240	ATM	71.8322	9/13	1719	JM				
23	70.7376	8/27	2131	JM	70.7382	8/30/99	1259	ATM	70.7376	9/8	1715	JM
24	73.2173	8/27	2130	JM	73.2182		1301	ATM	73.2176	9/8	1713	JM
25					72.6505	↓	1257	ATM	72.6504	9/8	1716	JM
26	71.7865	8/27	2132	JM	71.7868	8/31/99	1322	ATM				
27	72.3294	9/11/99	1235	ATM	72.3294	9/8	1718	JM				
28	70.5955	8/27	2127	JM	70.5956	8/31/99	1324	ATM				
29	71.5183	8/27	2133	JM	71.5185	↓	1318	ATM				
30	70.7845	8/27	2128	JM	70.7855	8/30/99	1302	ATM	70.7851	9/8	1714	JM
31	69.6655	8/27	2129	JM	69.6655	8/31/99	1327	ATM				
cont. 23	70.7375	9/11	1239	ATM								
cont 24	73.2175	9/11	1242	ATM								

Checked By: A.T.Myren Date: 9/11&13/99 Time: ATM

QA REWEIGH

Beaker #	WT	Date	Time	By

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
68	93	46	8/27/99	2052	ATM
67	81	48	8/30/99	1154	ATM
63	76	48	8/31/99	1310	ATM
70	84	47	9/8/99	1705	ATM
69	84	46	9/11/99	1202	ATM
64	77	49	9/13/99	1926	ATM

WOODSTOVE DATA SHEET #4-2:
INITIAL BEAKER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date: 6/1/99 Time: 1400 By: A.T. Myers

Beaker #	First Wt	Date	Time	By	Second Wt	Date	Time	By	Third Wt	Date	Time	By
1	65.4847	7/17	1636	OBM	65.4847	7/18/99	1612	ATM	← B	KAN	K	
2	66.1504		1638	OBM	66.1506	↓	1614	ATM	7/	13/99		
3	67.8572		1640	OBM	67.8567	↓	1616	ATM				
4	67.5881		1642	OBM	67.5880	↓	1618	ATM				
6	67.4268		1644	OBM	67.4266	↓	1620	ATM				
7	65.5436		1646	OBM	65.5437	↓	1622	ATM				
8	66.0212		1660	OBM	66.0211	↓	1623	ATM				
9	66.6294		1652	OBM	66.6295	↓	1625	ATM				
10	66.0889		1654	OBM	66.0888	↓	1627	ATM				
11	65.7015		1656	OBM	65.7013	↓	1628	ATM				
12	56.0656		1658	OBM	56.0653	↓	1632	ATM				
13	57.8948		1700	OBM	57.8944	↓	1630	ATM				

Checked By: A.T. Myers Date: 7/18/99 Time: 1800

QA REVEICH

Beaker #	WT	Date	Time	By

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
65	78	49	7/17/99	1825	ATM
63	77	45	7/18/99	1604	ATM

WST5-Form9,Pg1,Rev4/90
Unit Kuma Wood Classic
Run # EPA 3
Date: 9/14 199

WOODSTOVE DATA SHEET #4-3: CONSTANT FINAL WEIGHTS

FINAL BEAKER WEIGHTS

Beaker #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
30	✓	9/16	1748	ATM	70.791	9/18	1304	ATM	70.791	9/19	1150	TM				

FINAL FILTER WEIGHTS

Filter #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
934	.8022	9/14	1650	ATM	.8016	9/15	0831	ATM	.8017	9/17	3053	TM	.8015	9/18	1248	ATM
935	.8054	9/14	1655	ATM	.8049	9/15	0831	ATM	.8050	9/18	1312	TM	.8050	9/23/99	2036	JM

QA REWEIGH: FINAL WEIGHTS

Date	Beaker #	Final Wt	By

Date	Filter #	Final WT	By

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	1999 Date	Time	By	WB	DB	%RH
1	9/15	0820	ATM	66	82	42
2	9/17	2015	ATM	66	79	49
3	9/18	1217	ATM	65	78	48
4	9/19	1245	ATM	62	75	47
5	9/23	0028	ATM	65	79	47

SCALE ROOM ENVIRONMENTAL CONDITIONS

6						
7						
8						
9						

Comments

WOODSTOVE DATA SHEET #4-3: CONSTANT FINAL WEIGHTS

Blank
7/18/99

WST5-Form9, Fig1, Rev4/99
Unit Kuma Wood Classic
Run #
Date: 91 199

FINAL BEAKER WEIGHTS

Beaker #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
1	✓	7/21/99	1435	ATM	65.4852	8/4/99	1715	ATM	65.4846	8/8/99	1742	ATM	65.4847	8/9	1642	ATM

FINAL FILTER WEIGHTS

Filter #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By

QA REWEIGH: FINAL WEIGHTS

Date	Beaker #	Final Wt	By
Date	Filter #	Final WT	By

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	1999 Date	Time	By	WB	DB	%RH
1	8/4	1705	ATM	69	83	49
2	8/8	1700	ATM	64	78	46
3	8/9	1615	ATM	69	84	46
4						
5						

SCALE ROOM ENVIRONMENTAL CONDITIONS

6						
7						
8						
9						

Comments

WOODSTOVE DATA SHEET #4-4
SCALE QA SHEET

Dates From 1/9/99
Through 7/17/99

Scale Mettler
Model AE100
SN K04827

Level	Recalibrated	100g Weight	10g Weight	1.0g Weight	100mg Weight	20mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	Yes P.O.	99.9999	10.0001	1.0002	.1003	.0203	1/9/99	1243	ATM	58	70	48
✓	No	100.0002	10.0000	1.0000	.1000	.0200	1/14/99	1113	ATM	62	75	47
✓	YES P.O.	99.9998	10.0002	1.0000	.0999	.0201	1/23/99	1100	ATM	63	77	43
✓	YES	99.9999	10.0000	1.0000	.1000	.0201	1/24/99	1318	ATM	59	74	45
✓	YES	99.9996	10.0002	1.0000	.1000	.0200	2/1/99	0910	ATM	55	69	39
✓	YES	99.9997	10.0001	1.0001	.1002	.0201	2/2/99	0939	ATM	60	73	46
✓	YES	99.9999	10.0001	1.0001	.1001	.0200	2/3/99	1555	ATM	63	76	48
✓	YES	99.9999	10.0000	1.0001	.1001	.0201	2/7/99	1235	ATM	62	76	45
✓	YES	99.9998	10.0000	1.0000	.1000	.0200	2/10/99	1600	ATM	63	77	45
✓	YES	99.9993	10.0000	1.0001	.1000	.0200	2/19/99	0246	ATM	64	78	46
✓	NO	99.9999	10.0000	1.0000	.1000	.0200	2/21/99	1313	ATM	65	80	44
✓	NO	99.9997	10.0000	1.0001	.1000	.0200	3/5/99	1935	ATM	64	80	41
✓	YES P.O.	99.9997	10.0000	1.0000	.1001	.0200	3/6/99	1135	ATM	64	76	43
✓	YES	99.9997	10.0000	1.0001	.1000	.0200	3/13/99	1526	ATM	65	80	44
✓	YES	99.9999	10.0001	1.0001	.1001	.0200	3/14/99	1355	ATM	63	78	43
✓	NO	100.0001	10.0000	1.0000	.1000	.0200	3/15/99	1622	ATM	66	81	45
✓	Yes	99.9997	10.0000	1.0001	.1000	.0200	3/16/99	2025	ATM	65	82	39
✓	Yes	99.9996	10.0000	1.0001	.1001	.0200	3/17/99	1615	ATM	62	77	42
✓	Yes	99.9997	10.0000	1.0001	.1000	.0200	3/18/99	2140	ATM	66	84	43
✓	Yes	99.9998	10.0000	1.0000	.1000	.0200	3/20/99	1300	ATM	64	84	32
✓	Yes	99.9999	10.0000	1.0001	.1001	.0201	3/21/99	2215	ATM	61	74	47
✓	Yes	99.9997	10.0000	1.0000	.1001	.0200	3/22/99	0102	ATM	65	85	33
✓	Yes	99.9997	10.0000	1.0001	.1000	.0200	3/23/99	1115	ATM	69	84	46
✓	Yes	99.9998	10.0000	1.0002	.1001	.0201	3/24/99	1120	ATM	72	89	43
✓	Yes	99.9999	10.0000	1.0002	.1001	.0201	3/29/99	2038	ATM	69	72	45
✓	NO	99.9999	10.0002	1.0002	.1001	.0202	3/30/99	0610	ATM	66	80	47
✓	No	99.9999	10.0000	1.0000	.1001	.0201	3/31/99	1000	[illegible]	64	80	41
✓	NO	99.9996	10.0000	1.0000	.1001	.0201	4/6/99	1730	ATM	64	80	41
✓	Yes	99.9998	10.0001	1.0001	.1001	.0201	4/6/99	1030	ATM	61	75	44
QC Services		Audit	4/6/97	— wt.	Scale check after audit							
✓	NO	100.0003	10.0001	1.0001	.1001	.0201	4/6/99	1730	ATM			
✓	YES	99.9998	10.0001	1.0001	.1001	.0200	4/7/99	1721	ATM	65	85	33
✓	NO	99.9996	10.0000	1.0001	.1001	.0201	4/8/99	1346	ATM	67	80	50
✓	YES	99.9997	10.0000	1.0000	.1000	.0200	4/16/99	1230	ATM	66	82	43
✓	YES	99.9997	10.0000	1.0000	.1000	.0200	4/17/99	1625	ATM	68	84	43
✓	No	99.9999	10.0000	.9998	.0999	.0198	6/9/99	1050	ATM	49	72	45
✓	yes	99.9996	10.0001	1.0002	.1001	.0202	7/17/99	1825	ATM	65	78	49

WOODSTOVE DATA SHEET #4-4
SCALE QA SHEET

Dates From 7/18/99
Through 9/16/99

Scale Mettler
Model AE100
SN K04827

Level	Recalibrated	100g Weight	10g Weight	1.0g Weight	100mg Weight	20mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	No	99.9996	10.0000	1.0001	.1000	.0201	7/18/99	1604	ATM	63	77	45
✓	YES	99.9997	10.0000	1.0001	.1001	.0201	7/19/99	1835	ATM	64	77	49
✓	Yes	99.9996	10.0000	1.0002	.1002	.0202	7/20/99	1854	ATM	71	85	80
✓	Yes	99.9997	10.0001	1.0001	.1001	.0201	7/21/99	1306	ATM	69	84	50
✓	Yes P.O.	99.9996	9.9999	1.0000	.1000	.0200	7/22/99	2145	ATM	64	80	41
✓	Yes	99.9998	10.0000	1.0000	.1000	.0200	7/23/99	0745	ATM	62	76	45
✓	No	99.9998	10.0000	1.0000	.1000	.0200	7/24/99	1340	ATM	66	80	47
✓	YES P.O.	Would not calibrate					8/3/99	2117	ATM	70	84	49
✓	Yes	99.9998	10.0001	1.0002	.1000	.0201	8/4/99	1705	ATM	69	83	49
✓	NO	99.9998	10.0001	1.0001	.1000	.0200	8/5/99	2106	ATM	65	78	49
✓	Yes	99.9998	10.0000	1.0000	.1000	.0200	8/6/99	1536	ATM	68	81	50
✓	No	99.9999	10.0000	1.0001	.1000	.0200	8/7/99	1513	ATM	66	80	47
✓	Yes	99.9996	10.0001	1.0002	.1001	.0201	8/8/99	1700	ATM	64	73	46
✓	Yes	99.9997	10.0000	1.0001	.1000	.0200	8/9/99	1225	ATM	68	82	48
✓	Yes	99.9998	10.0001	1.0001	.1001	.0200	8/9/99	1615	ATM	69	84	46
✓	No	99.9997	10.0000	1.0000	.1000	.0200	8/10/99	1327	ATM	70	84	49
✓	Yes	99.9998	10.0000	1.0000	.1001	.0200	8/11/99	1043	ATM	67	81	48
✓	Yes	99.9996	10.0000	1.0001	.1001	.0201	8/11/99	2035	ATM	64	78	46
✓	Yes	99.9997	10.0000	1.0001	.1000	.0200	8/13/99	1230	ATM	64	80	47
✓	Yes	99.9998	10.0001	1.0002	.1002	.0201	8/14/99	1929	ATM	63	76	48
✓	Yes	99.9998	10.0000	1.0001	.1001	.0201	8/16/99	1135	ATM	64	77	48
✓	Yes	99.9998	10.0001	1.0001	.1001	.0201	8/17/99	1750	ATM	68	83	46
✓	Yes	99.9997	10.0000	1.0001	.1001	.0200	8/17/99	1650	ATM	70	84	47
✓	No	99.9999	10.0001	1.0000	.1000	.0201	8/22/99	2052	ATM	69	83	46
✓	No	99.9999	10.0001	1.0002	.1001	.0202	8/30/99	1154	ATM	67	81	48
✓	No	99.9998	9.9999	1.0000	.1000	.0200	8/31/99	1310	ATM	63	76	48
✓	Yes	99.9997	10.0000	1.0000	.1000	.0200	8/31/99	1844	ATM	65	79	44
✓	Yes	99.9998	10.0000	1.0000	.1000	.0200	9/2/99	1032	ATM	60	74	43
✓	Yes	99.9998	10.0000	1.0002	.1002	.0200	9/8/99	1705	ATM	70	84	47
✓	YES	99.9996	10.0001	1.0002	.1001	.0201	9/11/99	1202	ATM	69	84	46
✓	Yes	99.9996	10.0000	1.0001	.1001	.0201	9/12/99	2058	ATM	70	84	49
✓	Yes	99.9996	10.0001	1.0001	.1000	.0201	9/13/99	1926	ATM	64	77	44
✓	Yes	99.9997	10.0001	1.0002	.1002	.0202	9/14/99	1335	ATM	81	72	(65)
✓	Yes	99.9996	10.0001	1.0002	.1002	.0201	9/14/99	2025	ATM	84	78	44
✓	Yes	99.9998	10.0001	1.0000	.1001	.0200	9/15/99	0820	ATM	67	66	42
✓	Yes	99.9996	10.0001	1.0001	.1001	.0201	9/16/99	0845	ATM	69	84	46
✓	No	99.9996	10.0000	1.0000	.1000	.0200	9/16/99	1655	ATM	70	84	49

Dates From 9/17/99

Through _____

WOODSTOVE DATA SHEET #4-4
SCALE QA SHEET

Scale Mettler
Model AE100
SN K04827

Level	Recali-brated	100g Weight	10g Weight	1.0g Weight	100mg Weight	20mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	Yes	99.9998	10.0000	1.0001	.1001	.0201	9/17/99	2045	ATM	66	79	49
✓	Yes	99.9997	10.0000	1.0000	.1001	.0200	9/18/99	1217	ATM	65	78	48
✓	No	99.9996	10.0000	1.0000	.1000	.0200	9/19/99	1245	ATM	62	75	49
✓	Yes	99.9998	10.0001	1.0001	.1001	.0201	9/23/99	2028	ATM	65	79	47
✓	Yes	99.9997	10.0000	1.0000	.1000	.0201	9/24/99	1145	ATM	64	77	49

Unit: Kuma Wood Classic
Run: EPA 3
Date: 9/14/1999
Technicians: ATM RLS
WST20, Form5

Woodstove Particulate Catch Processing Sheet
Woodstove Data Sheet #5
EPA M5G-1

Filters

Filter # (F) 934 ✓ Beaker # 30 Final Wt. 70.7912 g ✓

Final Wt .8015 g Ml 35 Tare Wt. 70.7851 g ✓

Tare Wt .7917 g ✓ Desc. Acetone Net Wt. .0061 g ✓

Net Wt .0098 g ✓

Filter # (R) 933 ✓ Beaker # _____ Final Wt. _____ g

Final Wt .8050 g ✓ Ml _____ Tare Wt. _____ g

Tare Wt .8048 g ✓ Desc. _____ Net Wt. _____ g

Net Wt .0002 g ✓

Acetone Blank Calculation: Blank done 7/19/99

Blank Beaker # 1 Final Wt 65.4847

Ml 50 Tare Wt 65.4847

Desc Acetone Net Wt .0000

.0000 g ÷ 50 ml = .00000 g/ml

Particulate Catch Calculation

Filter: .0098 g ✓

Filter: .0002 g ✓

Beakers: .0061 (Total Catch) − (35)(.0000) (Ml of Acetone Blank Value/Ml of Acetone) = .0061 g ✓

Total Catch = .0161 g ✓

Unit Kuma Wood Classic
Run # EPA 3
Date 9/14/1999
Technician ATM RLS
WST6-Form1, Rev8/96

MISCELLANEOUS TEST DATA
WOODSTOVE DATA SHEET #8

Useable Firebox Dimensions: See QC Section Useable Volume: 2,223 ft^3

Dilution Tunnel Draft (If applicable): Start 00.0 Stop 00.0

Test Chamber Air Velocity: Start: 00.0 Stop: 00.0 Avg: 00.0

Wet Bulb/ Start: WB: 64 °F DB: 76 °F 1.6 % Amb Moisture 51 %RH

Dry Bulb Stop: WB: 70 °F DB: 82 °F 2.0 % Amb Moisture 54 %RH

$\bar{X}$ = 1.8 % Ambient Moisture $\bar{X}$ = 52.5 % Relative Humidity (RH)

Empty Stove Wt: 419.3 lbs.

Empty Stove Wt with Stack (Inc. Oil Seal) Wet: 570.8 lbs. Dry: 509.1 lbs.

Empty Stove Wt with Stack and Ash Ash: — lbs. Total: — lbs.

Kindling Wt. Paper: 0.3 lbs. Wood: 4.0 lbs.

Pre Burn Fuel Wt. 14.7 + 14.7 + 14.2 Total: 43.6 lbs. ✓

Total Kindling and Pre Burn Fuel Wt 47.9 lbs. ✓

Coal Bed Wt-lbs: Range (512.7 - 512.1) 3.6 - 3.0 lbs. Actual: (3.4) lbs.

Allowable Amount of Charcoal that can be removed:

Coal Bed Wt. Range $\frac{3.6}{\text{Upper Wt.}} + \frac{3.0}{\text{Lower Wt.}}$ /2 X .25 = .8 ✓ lbs.

Test Fuel Wt-lbs: Ideal 15.6 lbs. Range: 17.1 - 14.1 lbs. Actual: 14.6 lbs.

Test Fuel Size (pcs.) (.75 x 1.5 x 5" Flanges) 16 Pcs.

2 x 4's x 16 1/16	"	3 Pcs	6.1 lbs.	41.8 %
4 x 4's x 16 1/16	"	2 Pcs	8.5 lbs.	58.2 % ✓

✓

Est. Dry Burn Rate (Kg/Hr.) $\frac{14.6 - (14.6 \times .1758)}{2.2046} \times \frac{60}{260}$ = 1.2596 ✓ Est. Dry Burn Rate (Kg/Hr)

Est EPA Heat Output (HO_E) (Avg BTU's/Hr) (19,140) X $\frac{63}{100}$ x 1.2596 = 15,188 ✓ Est Heat Output (HO_E) BTU's/Hr

Comments:

Stove Operating Data
Woodstove Test Data Sheet #9
Cold Start

Unit: KUMA WOOD CLASSIC
Run: EPA 3
Date: 9/14/99
Technician(s): ATM, KLS.
Data Sheet #9 - Rev 1/98-Pg.2

Fire Started: 0805 P.D.S.T.

Warm up and Preburn: Primary Air: Wide open from ignition until the start of preburn when the primary air control(s) was (were) adjusted to the run setting of 5/8" OPEN. At the run setting until the start of the test.

Secondary Air: No Controls, Naturally drafted.

Secondary Burn/Cat Bypass:
N/A

Charcoal Bed Preparation: Broke up, raked and leveled the coal bed prior to the addition of each warm up/pre burn fuel charge. Starting 1:30 before the start of the test, broke up, raked and leveled the coal bed. In stove for 35 seconds.

Test: Door wide open during loading _____ min 45 sec, then closed.

Primary Air: Wide open during the start of the test until 4:55.
Adjusted to the run setting of 5/8" open between 4:55 and 5:00.
At the run setting of 5/8" open at 5:00 into the run.

Secondary Air: No Controls, Naturally drafted.

Secondary Burn/Cat Bypass:
N/A

Fan: ON (OFF) during the warm up, ON/OFF High during the preburn, ON/OFF at the start of the test, ON/OFF for the first 30 minutes of the test, ON/OFF high at 30 minutes into the test, ON/OFF for the rest of the test.

Test Run Anomalies:
Norm. Except run tailed out much more than expected. This was supposed to be a medium high.

Unit Kuma Wool Classic
Run # EPA 3
Date 9/14/1999
Technician ATM RLS
Page 1 of 3
WST7-Form2-A, Rev10/88

WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-1

Wood Data: Kindling: A mix of the below grades

	Size	Mill	Grade	Species
Pre Burn	2X4	Canyon Lumber	#2 & Better	D. Fir SFC Grn
Test Fuel	2X4	Canyon Lumber	#2 & Better	D. Fir SFC Grn
	4X4	R.I.B. Const.	#1	D. Fir SFC Grn

All grades WCLB Rules unless otherwise noted.

Warm up Information:

1st Warm up/Pre Burn Fuel charge (14.7 lbs) added at 0825.
2nd Warm up/Pre Burn Fuel charge (14.7 lbs) added at 0925.
3rd Warm up/Pre Burn Fuel charge (14.2 lbs) added at 1023.
4th Warm up/Pre Burn Fuel charge (_____ lbs) added at _____.
5th Warm up/Pre Burn Fuel charge (_____ lbs) added at _____.
6th Warm up/Pre Burn Fuel charge (_____ lbs) added at _____.
7th Warm up/Pre Burn Fuel charge (_____ lbs) added at _____.
8th Warm up/Pre Burn Fuel charge (_____ lbs) added at _____.

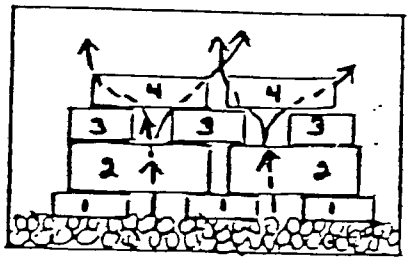
The coals were scooped out of the stove immediately prior to adding the 3rd pre burn/warm up fuel charge. The stove lost 1.7 lbs. 3.2 lbs. of coals were put back in the stove after the scoop.

All pre burn/warm up fuel pieces were [redacted] 16" inches long. All preburn pieces/fuel charges were "ricked" in the stove. The pieces in the bottom layer in each rick contained 2 pcs that were 16 inches long and were loaded flat and perpendicular to the door. The pieces in the second layer in each rick were loaded on their side (edge) approximately parallel to the door and contained 4 pcs 16 inches long. The third layer (and fourth layer if present) was loaded flat, perpendicular to the door and contained 2 pcs 16 inches long. The majority of the pieces in each rick were in the second layer which had an approximate 0.5-1.0" space between pieces. (The loading directions indicate the direction of the longest dimension on each piece relative to the loading door opening.) Each pre burn/warm up fuel charge normally weighs within the weight range allowed for the actual test fuel charge

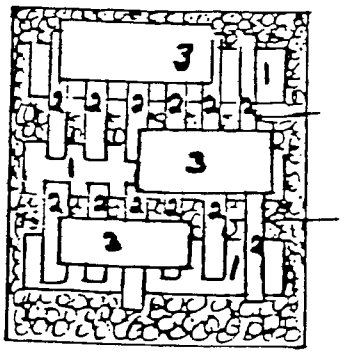
WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-2

Warm up Information (cont.):

Each warm up/preburn fuel charge was ricked in exactly (as much as possible) the same manner and the weight of each rick was usually within the allowable weight range for the test fuel charge. The physical arrangement and alignment of each rick was designed to accomplish three (3) things: (1)The bottom layer was nestled firmly into the coal bed and was as close to being level with the bottom of the stove as possible, thus providing a stable loading platform for the rest of the rick, keeping it in a ricked state (as opposed to a col- lapsed or fallen down state) untill the rick reached the charcoal stage and sags or collapses of its own accord. (2) It enhances the flow of primary air through the ricked preburn fuel charge, for the primary air would flow through the spaces between the pieces in the first layer and then up through the spaces between the pieces in the second, third and, if present, fourth layers. (3) It maximized, as much as possible, the surface to volume ratio of each preburn fuel charge, thereby allowing the fire immediate access to as much wood surface as possible and, thereby, insuring uniform charcoalization. All three of these enhance combustion and so get the stove as hot as possible during the warm up period, therby maximizing the amount of heat (BTU's) stored in the stove. The actual preburn was not started until the stove surface temperatures had maximized and stabilized, thus indicating that the amount of heat stored in the stove had peaked. For this stove, the thermal storage was monitored using the TOP surface temperature(s) and the peak value(s) obtained were 450 °F.



Front View



Top View

The arrows indicate the direction of the air flow through the rick.

The primary air was adjusted to the run setting of 5/8" open 60 lbs above the upper charcoal bed weight.

Unit Kuma Wood Classic
Run # EPA 3
Date 9/14/99
Technician ATM RLS JP
Page 3 of 3
WST5-Form2-Rev11/89

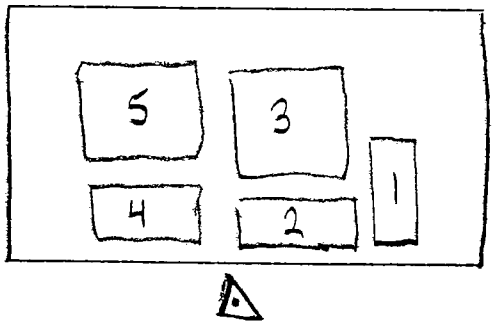
WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-3

Additional Comments: Test Start Sequence: (1) Turned Fan Off (2) Opened Primary Air Control Wide Open (3) Opened door (4) Loaded Test Fuel Into Stove (5) cleared coals away from in front of the LPPO (6) Photograph (7) closed door,

TOTAL ELAPSED TIME 0:45.

Test Fuel Charge Loading Information:

Test Fuel Charge and Loading Sequence Diagram



FRONT of stove view

4 X 4's: 3 & 5

2 X 4's: 1, 2 & 4

Loading Sequence: 1, 2, 3, 4 And Then 5

Driest Pcs in Load 2 & 4, 3

Loaded the test fuel charge on an essentially level, Medium to large sized, average to hot coal bed (in appearance, color and temperature for a Medium high burn rate. Ignition: N 0:30 Load 0:45

1:10 VC to baffle.
2:14 Flames / seconds past front tube
(*) 2:52 Gas Balance
3:55 Engulfed.
5:00 Flames ↓. Maintained VC to baffle w/ 2nds / flames above 3 & 5, Front Tube flickering on / off. Stayed on balance.
8:10 CO ↓. Never lost balance. Very good start,

Unit: Kuma Wood Classic
Run: EPA 3
Date: 9/14/1999
Technician: ATM RLS

FUEL MOISTURE
WOODSTOVE TEST DATA SHEET #10

WST1-Form7-Rev11/89

Room Temperature: 69 °F Correction Factor: 0

NOTE: Record readings to the nearest 0.5% moisture
Uncor Values are corrected for temperature: Yes ✓. No ____
Time Test Fuel Moisture Readings taken at: 1020
Calibration Checks: X ✓ Y ✓ 12.5 12.5 22.0 22.5

Pc #	Dimen	Use	Top		Bottom		Side		Piece Avg Corrected
			Uncor	Cor	Uncor	Cor	Uncor	Cor	
1	2x4x8'	K	12.0	12.8	12.0	12.8	12.5	13.3	(12.967)
2									
3									
4	2x4x8'	P	21.5	23.1	21.5	23.1	21.5	23.1	23.100
5	"	|	20.5	22.0	21.0	22.6	21.0	22.6	22.400
6	"	|	21.5	23.1	21.5	23.1	21.5	23.1	23.100
7	"	↓	21.0	22.6	21.5	23.1	21.0	22.6	22.767
8									(91.367)
9									
10	2x4-16 1/16"	T	18.0	19.2	18.0	19.2	18.0	19.2	19.200
11	"	|	21.5	23.1	21.5	23.1	21.0	22.6	22.933
12	"	↓	19.5	20.9	19.5	20.9	19.0	20.3	20.700
13									
14	4x4-16 1/16"	T	19.0	20.3	19.0	20.3	18.5	19.8	20.133
15	"	↓	22.0	23.7	22.0	23.7	22.0	23.7	23.700
16									(106.1667)
17									
18									
19	5x1.5x.75	Spacers	20.5	22.0	20.0	21.4	20.0	21.4	21.600
20									OUT-Spacers

	Kindling	Pretest Fuel	Test Load
% Moisture - Dry Basis:	12.967%	22.842 %	21.333 %
% Moisture - Wet Basis:	11.478 %	18.594 %	17.582 %

To obtain Wet from Dry: $\frac{100 \times \%\ \text{Dry Rdg.}}{100 + \%\ \text{Dry Rdg.}}$ = % Moisture, Wet Basis

Acceptable Ranges: 16-20% wet; 19-25% dry
(17.5 - 22.5 on Meter [Uncor reading] at 70°F)

Key for Use: K= Kindling P= Pretest Fuel T= Test Fuel

Unit: Kuma Wood Classic
Run#: EPA 3
Date: 9/14/1999
Technician: ATM RLS

WOOD DENSITY DETERMINATION
WOODSTOVE TEST DATA SHEET #11

WST2-form11-Rev 6/90

Wood Piece: Nominal Dimensions: 3½" x 3½" x 1½" in

Depth (D): IN 1.541 cm 3.914

Width (W): IN 3.525 cm 8.954

Length (L): 3.488 in
3.492 in
3.492 in
3.498 in

Length $\bar{X}$ = IN 3.493 cm 8.872

Volume: 310.928 cm^3 (D X W X L)

MOISTURE: Room Temperature: 69 °F Correction Factor: 0

Uncorrected Meter Readings Corrected for temperature: Yes ✓ No ___

NOTE: Record moisture meter readings to the nearest 0.5%

	Uncor	Cor
Top:	21.0	22.6 %
Bottom:	21.0	22.6 %
Side:	20.5	22.6 %
$\bar{X}$:		22.400 %

Avg % Moisture (Dry) 22.400 %

Aug % Moisture (Wet) 18.301 %

Scale: Leveled In ✓ Out ✓
Zeroed: In ✓ Out ✓

Wet Weight: 171.0 g Dry Weight: 143.8 g

% Moisture Dried Basis: 15.906 %
[1 - (Dry Wt ÷ Wet Wt)] X 100

	Date	Time	Temp
Into Dryer	9/14/99	0955	214 °F
Out of Dryer	9/22/99	1548	214 °F

(Minimum Time in Dryer: 24 hrs.) Minimum Dryer Temp 100°C (212°F)

Density = 143.8 g (dry wt) ÷ 310.928 cm^3 (volume) = 0.4625 g/cm^3

Pellet Fuel Moisture Content Determination

Tare Beaker Wt. _____ g

Wet Wt: _____ g - _____ g = _____ g
Gross Wet Wt. Tare Beaker Wt. Net Wet Wt.

Dry Wt: _____ g - _____ g = _____ g
Gross Dry Wt. Tare Beaker Wt. Net Dry Wt.

% Moisture Dried Basis: _____ %
[1 - (Net Dry Wt ÷ Net Wet Wt.)] X 100

BURN RATE AND FLUE GAS DATA
WOODSTOVE DATA SHEET #12
WSTC-Form 14 Rev 1/88

Unit: Kuma Wood Classic Date: 9/14/19
Run: EPA 3 Technician(s): AT, RLC
Page: 1 of 3

END Wt: 512.5 lbs.

Minute / Time	Scale Wt	lbs left	Burn Rate	CO2 v.	CO2 %CO2	O2 v.	O2 %O2	Tel	CO v.	CO %CO	Bal	Wet Bulb	Dry Bulb	% H2O	Calc W/B	Stack	SO2 v.	SO2 PPM	Static Press.	Comments
0 / 1215	527.1	14.6	0	.307	7.61	47.8	11.94		24.5	1.23	6.2	91	143			294			-.045	Flow
5 / 20	526.0	13.5	1.1	.553	13.68	22.7	5.67	GAS BAL.	10.7	0.55	24.9	108	162			585			-.080	SO2 1.5
10 / 25	525.2	12.7	.8	.432	10.69	37.0	9.24		9.8	0.49	21.8	141	183			440			-.066	CO2 1.5
15 / 30	524.4	11.9	.8	.533	13.18	28.3	7.07		6.5	0.34	38.8	129	187			455			-.069	O2 1.5
20 / 35	523.5	11.0	.9	.572	14.15	25.7	6.42		5.0	0.25	56.6	132	192			472			-.071	CO 1.5
25 / 40	522.6	10.1	.9	.595	14.71	23.5	5.87		4.3	0.23	64.0	133	198			485			-.071	
30 / 45	521.7	9.2	.9	.641	16.85	18.4	4.60		10.2	0.52	30.5	134	205			511			-.073	
35 / 50	520.8	8.3	.9	.647	16.00	17.6	4.40		17.9	0.91	17.6	133	202			510			-.073	
40 / 55	519.9	7.4	.9	.632	15.63	18.7	4.67		13.2	0.66	23.7	131	195			502			-.074	
45 / 1300	519.1	6.6	.8	.622	15.38	19.6	4.90		7.9	0.40	38.4	128	189			490			-.073	
50 / 05	518.3	5.8	.8	.589	14.57	23.4	5.85		7.2	0.37	39.4	126	184			478			-.072	
55 / 10	517.8	5.3	.5	.569	14.07	25.4	6.35		4.4	0.22	64.0	125	182			472			-.070	
																4.84			(.937)	Flow
60 / 15	517.2	4.7	.6	.523	12.94	29.1	7.27		3.7	0.19	68.1	122	174			438			-.066	SO2 1.5
65 / 20	516.7	4.2	.5	.449	11.11	36.1	9.02		7.7	0.39	28.5	118	167			411			-.063	CO2 1.5
70 / 25	516.3	3.8	.4	.442	10.70	38.6	9.64		4.6	0.25	40.8	114	161			393			-.060	O2 1.5
75 / 30	516.0	3.5	.3	.404	10.00	39.5	9.87		6.8	0.36	37.8	112	157			380			-.058	CO 1.5
80 / 35	515.7	3.2	.3	.392	9.71	40.9	10.22		7.5	0.39	24.9	109	153			367			-.057	
85 / 40	515.4	2.9	.3	.382	9.46	41.8	10.44		7.1	0.37	25.6	107	150			358			-.056	
90 / 45	515.1	2.6	.3	.354	8.77	44.8	11.19		8.9	0.45	19.5	104	148			344			-.052	
95 / 50	514.9	2.4	.2	.333	8.25	46.3	11.57		9.7	0.49	16.8	101	146			329			-.051	
100 / 55	514.8	2.3	.1	.301	7.47	49.2	12.29		11.7	0.59	12.7	98	141			315			-.049	
105 / 1400	514.7	2.2	.1	.270	6.70	51.4	12.84	OUT BAL.	17.8	0.90	7.4	95	137			303			-.047	
110 / 05	514.6	2.1	.1	.257	6.38	52.4	13.07		19.2	0.97	6.6	92	135			294			-.045	
115 / 10	514.5	2.0	.1	.247	6.13	53.5	13.36		22.3	1.13	5.4	91	133			287			-.044	
																4.19			(.648)	
																7903			1.485	

BURN[illegible]TE AND FLUE GAS DATA
WOOD[illegible]JVE DATA SHEET #12
WST2-Form 14 Rev 1/88
END WT.: 512.5 lbs,

Unit: KUHA WOOD CLASSIC Date: 9/14/99
Run: EPA 3 Technician(s): ATH, BLC
Page: 2 of 3

Minute / Time	Scale Wt	lbs left	Burn Rate	1 CO_2 v.	1 CO_2 %CO_2	2 O_2 v.	2 O_2 %O_2	Tel	3 CO v.	3 CO %CO	T/C(1)T/C(2) Bal	Wet Bulb	Dry Bulb	% H_2O	Calc W/B	T/C(3) Stack	4 SO_2 v.	SO_2 PPM	Static Press.	Comments
120 / 1415	514.4	1.9	.1	.245	6.08	53.6	13.39		23.8	1.20	5.1	90	132			281			-.043	Flow
125 / 20	514.3	1.8	.1	.248	6.16	53.7	13.41		21.6	1.08	5.7	89	130			275			-.041	~~SO_2~~ 1.5
130 / 25	514.2	1.7	.1	.240	5.96	54.5	13.61		22.3	1.11	5.4	89	130			270			-.040	~~CO~~ 1.5
135 / 30	514.1	1.6	.1	.235	6.83	54.6	13.64		22.7	1.16	5.0	88	128			265			-.039	~~O_2~~ 1.5
140 / 35	514.0	1.5	.1	.232	5.76	55.0	13.74		23.5	1.19	4.8	88	128			260			-.039	~~CO~~ 1.5
145 / 40	513.9	1.4	.1	.232	5.76	55.1	13.76		24.0	1.20	4.8	88	127			257			-.038	
150 / 45	513.9	1.4	0	.212	5.27	56.9	14.21		24.0	1.20	4.4	88	126			252			-.038	
155 / 50	513.8	1.3	.1	.202	5.02	57.7	14.41		26.4	1.33	3.8	87	124			248			-.037	
160 / 55	513.7	1.2	.1	.198	4.93	58.2	14.54		27.6	1.40	3.5	87	123			245			-.036	
165 / 1600	513.6	1.1	.1	.178	4.43	59.8	14.94		32.8	1.64	2.7	87	123			242			-.036	
170 / 05	513.6	1.1	0	.185	4.61	58.9	14.71		30.5	1.53	3.0	87	122			239			-.035	
175 / 10	513.5	1.0	.1	.186	4.63	58.8	14.69		31.4	1.58	2.9	87	122			235			-.035	
																3068 ✓			.457	Flow
180 / 15	513.4	.9	.1	.185	4.61	59.4	14.84		28.1	1.41	3.3	87	121			232			-.035	~~SO_2~~ 1.5
185 / 20	513.4	.9	0	.184	4.58	59.6	14.89		28.3	1.41	3.2	87	121			229			-.034	~~CO~~ 1.5
190 / 25	513.3	.8	.1	.184	4.58	59.9	14.96		27.1	1.36	3.4	86	120			227			-.033	~~O_2~~ 1.5
195 / 30	513.2	.7	.1	.183	4.56	59.7	14.91		28.6	1.42	3.2	88	120			225			-.033	~~CO~~ 1.5
200 / 35	513.2	.7	0	.182	4.53	59.6	14.89		29.5	1.47	3.1	87	120			223			-.032	
205 / 40	513.1	.6	.1	.183	4.56	59.9	14.96		27.6	1.40	3.3	88	120			222			-.031	
210 / 45	513.1	.6	0	.177	4.41	60.4	15.09		28.6	1.43	3.1	89	120			220			-.031	
215 / 50	513.0	.5	.1	.178	4.43	60.3	15.06		28.2	1.43	3.1	89	120			217			-.030	
220 / 55	512.9	.4	.1	.181	4.51	60.1	15.01		28.0	1.41	3.2	90	120			216			-.030	
225 / 1600	512.9	.4	0	.164	4.09	61.7	15.41		28.8	1.45	2.8	90	119			213			-.030	
230 / 05	512.8	.3	.1	.168	4.19	61.4	15.34		26.9	1.35	3.1	90	118			211			-.030	
235 / 10	512.8	.3	0	.169	3.96	62.1	15.51		30.0	1.50	2.6	90	119			209			-.030	
																2644 ✓			.379	
																5712			1836	

BURN RATE AND FLUE GAS DATA
WOOD[illegible]VE DATA SHEET #12
WST2[illegible]rm 14 Rev 1/88

Unit: KUHN WOOD CHASSIS Date: 9/14/99
in: EPA 3 Technician(s): A.T.M
age: 3 of 3

END WT. 512.5 lbs

Minute / Time	Scale Wt	lbs left	Burn Rate	1 CO_2 v.	1 CO_2 %CO_2	2 O_2 v.	2 O_2 %O_2	Tel	3 CO v.	3 CO %CO	Bal	T/C(1) Wet Bulb	T/C(2) Dry Bulb	% H_2O	Calc W/B	T/C(3) Stack	4 SO_2 v.	SO_2 PPM	Static Press.	Comments
240 / 1615	512.7	.2	.1	.162	4.04	61.7	15.41		29.4	1.48	2.7	90	119			208			-.030	Flow
245 / 20	512.7	.2	0	.159	3.96	62.3	15.56		27.8	1.39	2.9	90	117			206			-.030	SO_2 1.5
250 / 25	512.6	.1	.1	.153	3.82	62.6	15.64		29.5	1.48	2.6	90	117			204			-.029	CO_2 1.5
255 / 30	512.6	.1	0	.158	3.94	62.3	15.56		28.2	1.42	2.8	90	116			202			-.028	O_2 1.5
260 / 35	512.5	0	.1	.167	4.16	62.0	15.49		23.5	1.18	3.5	90	117			201			-.028	CO 1.5
265 / 40																1031			.145	
270 / 45																				
275														53		14,636			2.466	
280																				
285																216			-.047	
290																				
295																				
[illegible]																				
300																				Flow
305																				SO_2 1.5
310																				CO_2 1.5
315																				O_2 1.5
320																				CO 1.5
325																				
330																				
335																				
340																				
345																				
350																				
355																				
[illegible]																				
[illegible]																				

Pre Burn Start wt. 6.0 lbs.

Test Start wt. Range 572.7 - 572.1 lbs.

PRE BURN DATA RECORD SHEET #13
WST2-Form16

BARO. PRESSURE 28.66 in Hg

Unit: Kuma Wood Classic Date: 9/14/19
Run: EPA 3 Technician(s): ATM RLS
Page: 1 of 1

Reading Number	Minute Time	Scale Weight	Burn Rate	T/C#-3 Stack	4 Stove Top	5 Left Side	6 Back	7 Right Side	8 Bottom	9 Firebox	10 2nd Burn Catalytic	11 Room Temp	Static	Hot Box On — Comments (1.0" from side)
1192	0 1045	578.7	0	669	931	592	415	610	499	876	1660	75	-.090	Primary Air Set at 5/8" OPEN
1200	5 50	577.8	.9	548	881	615	395	623	495	879	1449	76	-.080	Secondary Air Set at N/A
1030	10 55	576.8	1.0	530	860	625	399	624	490	996	1447	76	-.078	Fan: ON HIGH
1071	15 1100	575.9	.9	516	857	634	398	622	485	1082	1475	75	-.076	TUNNEL ON AT: 1047
1060	20 05	575.2	.7	493	808	642	395	620	477	1103	1448	75	-.073	Buckets IN LID
1835	25 10	574.7	.5	470	764	644	389	618	470	1055	1482	74	-.069	ANALYZERS SPANNED
1340	30 15	574.3	.4	411	673	647	386	620	463	1028	1417	75	-.062	Pumps turned on at: 1115
1124	35 20	574.1	.2	405	623	650	391	618	459	1021	1556	75	-.063	RAKE CONES ΔT
1053	40 25	573.9	.2	380	608	643	392	611	454	1018	1260	74	-.058	
1030	45 30	573.7	.2	354	550	634	386	607	449	999	1158	76	-.053	Check WB/DB: 86/100 572.2
991	50 35	573.5	.2	337	507	625	381	588	443	977	1126	75	-.051	
978	55 40	573.4	.1	329	485	618	377	578	440	956	1093	75	-.050	499.6
														Probe IN TUNNEL
972	60 45	573.2	.2	323	468	606	371	567	437	947	1096	76	-.049	489.8
958	65 50	573.1	.1	317	456	595	364	557	435	933	1071	76	-.048	481.4
944	70 55	573.0	.1	311	446	588	362	549	435	928	1047	76	-.047	476.0
942	75 1200	572.9	.1	306	438	579	356	542	435	906	1045	76	-.046	470.0
931	80 05	572.7	.2	301	429	571	352	534	435	893	1036	77	-.045	464.2
927	85 10	572.6	.1	298	421	563	347	528	435	895	1008	78	-.045	458.8
927	90 15	572.5	.1	294	412	555	342	523	435	890	997	77	-.045	✓ 453.4

TEMPERATURES
RECORD SHEET #14
WST2-Form14 Rev7/96

Unit: Kuma Wood Classic Date: 9/14/19
Run: EPA 3 Technician(s):
Page: 1 of 3 KTM DLS

Rear 2nd

T/C#	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Minute / Time	Stove Top	Left Side	Back	Right Side	Bottom	Firebox	2nd Burn [redacted]	Room Temp	Tunnel	C. Gas Box	Impinger Out	5G-1 Filter	5G-1 Condenser	[redacted]	Hot Box
0 / 1215	412	555	342	523	435	890	997	77	101	248	38	80	48	927	248
5 / 20	453	538	353	571	435	864	1305	77	125	248	38	82	36	1234	248
10 / 25	612	530	342	499	435	835	1256	78	118	249	39	85	36	984	249
15 / 30	663	514	335	486	432	836	1276	78	117	250	39	86	36	1119	250
20 / 35	707	504	333	482	429	840	1344	79	118	250	39	87	36	1163	249
25 / 40	735	530	331	483	423	861	1277	79	119	250	38	88	36	1209	249
30 / 45	766	541	332	489	418	886	1374	78	122	250	39	88	36	1225	249
35 / 50	715	564	317	506	413	910	1537	79	123	250	39	88	36	1208	249
40 / 55	764	580	304	519	407	930	1650	79	118	250	39	88	36	1257	248
45 / 300	755	592	295	532	402	953	1615	79	115	250	39	88	36	1316	248
50 / 05	739	602	294	542	398	970	1563	78	113	250	39	88	36	1370	248
55 / 10	725	611	298	550	397	980	1436	79	113	249	39	88	36	1373	248
	(8106)	(6669)	(3870)	(6122)	(5024)	(10,745)	(16,630)	(940)							
60 / 15	688	619	303	556	395	998	1371	80	111	249	39	88	36	1315	250
65 / 20	644	623	308	560	395	991	1329	80	109	249	39	88	36	1317	250
70 / 25	600	622	309	562	393	969	1314	81	107	249	39	88	36	1258	250
75 / 30	581	619	310	563	394	948	1187	80	106	249	40	89	36	1235	250
80 / 35	565	614	311	562	395	938	1176	80	105	249	39	89	36	1216	250
85 / 40	544	608	313	558	397	966	1296	81	104	249	39	89	36	1162	250
90 / 45	615	607	314	551	399	989	1178	81	103	249	39	89	36	1199	249
95 / 50	486	606	317	542	401	994	1095	81	102	249	39	89	36	1261	249
100 / 55	464	603	320	535	402	983	1080	81	101	249	39	89	36	1176	249
105 / 1400	441	596	318	526	402	966	1022	81	100	249	39	89	36	1065	249
110 / 05	424	585	313	516	403	947	988	82	99	249	39	88	37	1045	249
116 / 10	410	576	308	507	403	922	955	82	99	250	40	88	37	1053	249
	(6362)	(7278)	(3744)	(6538)	(4779)	(11,611)	(13,891)	(970)							
	14,468	13,969	7620	12,660	9803	22,356	30,521	910							

TEMPERATURES
RECORD SHEET #14
WST2-Form14 Rev7/96

Unit: KUMA WOOD CLASSIC Date: 9/14/99
Run: EPA 3 Technician(s): ATM, LL, ...
Page: 2 of 3

T/C# / Minute / Time	4 Stove Top	5 Left Side	6 Back	7 Right Side	8 Bottom	9 Firebox	10 2nd Burn ~~Catalyst tr~~	11 Room Temp	12 Tunnel	13 C. Gas Box	14 Impinger Out	15 5G-1 Filter	16 5G-1 Condenser	17 REAR 2nd ~~Con-dar~~	18 HOT BOX
120 1415	396	565	304	498	404	901	929	82	98	250	40	88	37	1036	248
125 20	384	556	300	490	403	885	915	83	98	250	40	88	37	1026	250
130 25	377	546	295	482	403	864	899	82	98	250	40	88	37	1004	250
135 30	371	537	292	474	403	850	886	83	97	250	40	88	37	977	250
140 35	364	527	290	467	404	841	874	83	97	250	40	88	37	967	250
145 40	359	519	287	460	403	831	870	83	97	250	40	88	37	1028	250
150 45	357	511	282	454	402	802	861	83	97	250	40	88	37	947	250
155 50	346	502	274	449	401	780	847	83	96	250	40	88	37	925	249
160 55	342	493	268	443	400	761	835	83	96	250	40	88	37	912	249
165 1500	335	483	262	438	398	742	806	83	96	250	40	88	37	837	249
170 05	330	473	257	431	396	729	801	83	96	249	38	88	37	826	249
175 10	326	464	252	426	394	717	786	84	96	249	37	88	37	819	249
	4281	6176	3363	6512	4811	9703	10,300	995							
180 15	322	454	248	420	392	709	778	84	96	249	37	88	37	817	249
185 20	317	447	245	416	390	706	770	82	96	249	37	88	37	817	250
190 25	312	440	242	411	388	704	768	82	95	249	37	88	37	814	250
195 30	310	434	241	406	387	702	756	83	96	249	38	88	37	839	250
200 35	306	428	239	402	385	704	746	84	95	249	38	88	37	846	250
205 40	303	423	238	397	383	682	738	84	95	249	38	88	37	797	250
210 45	301	419	239	393	382	674	731	84	95	249	38	88	37	788	250
215 50	297	415	239	389	379	665	724	84	95	249	38	88	37	781	249
220 55	295	411	238	385	377	660	719	84	95	249	39	88	37	787	249
225 1600	291	406	236	381	375	645	702	84	95	249	39	88	37	759	249
230 05	288	401	234	376	374	637	697	84	95	250	39	88	37	769	249
235 10	286	396	232	373	372	629	688	85	95	250	39	88	37	733	733
	3628	5074	2871	4749	4584	8117	8817	1004							
	7909	11,250	6234	10,261	9395	17,820	19,126	1999							

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TEMPERATURES
RECORD SHEET #14
WST2-Form14 Rev7/96

Test: KUMA WOOD CLASSIC Date: 9/14/99
: EPA 3 Technician(s): ATH, LS,
Page: 3 of 3

T/C# / Minute Time	4 Stove Top	5 Left Side	6 Back	7 Right Side	8 Bottom	9 Firebox	10 2nd Burn ~~Catalytic~~	11 Room Temp	12 Tunnel	13 C. Gas Box	14 Impinger Out	15 5G-1 Filter	16 5G-1 Condenser	17 REAR SWD ~~Con-dar~~	18 Hot Box
240 15	282	392	230	368	370	620	687	84	95	250	39	88	37	722	248
245 20	280	387	228	364	369	611	678	83	95	250	39	88	37	717	249
250 25	278	383	226	360	368	604	669	84	94	250	39	88	37	740	249
255 30	275	378	225	356	366	604	663	84	94	250	39	88	37	760	250
260 35	272	315	225	352	364	605	662	83	94	250	39	88	37	799	250
265 40	1387	1915	1134	1800	1837	3044	3359	418							
270 45															
275	93,764	97,134	14,988	24,721	21,035	43,220	53,006	4397	53	AVG. STOVE TEMP	CHANGE		START:	453,4	✓
280													STOP:	317,6	✓
285	4488	612	283	4606	397	815	1000	82					ΔT:	-135,8	✓
290															
295															
300															
305															
310															
315															
320															
325															
330															
335															
340															
345															
350															
355															

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-1

Site: Myren Consulting, Woodinville, WA Date: 9/14/99 Analyte: CO_2

Source: Kuma Wood Classic Run #: EPA 3

Zero Cyl #: 719 430 Conc. 00.0 % CO_2 Cyl Press: 1850 psi

Certified by: Oxarc Date: 4/1/99

Span Cyl #: 250-794 Conc. 12.5 % CO_2 Cyl Press: 1310 psi

Certified by: Oxarc Date: 3/26/99

Analyzer: Make: Horiba Model: PIR-2000 SN: 607024

Range: 0 - 25.0% CO_2 Analyzer Output: 0 - 1.0 v.

Flow: 1.5 SCFH Measured by: Rotameter: X Flowmeter:

EPA Span Value = 25.0% CO_2

EPA Control Limits = ± 2.5% of 25.0% CO_2 = ± 0.625% CO_2

Pre Run Audit: By: RLS Time: 1110 Temp: 75 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	.000	00.0	00.0	.000	.0446	+.0446	+0.18
Span	50.0	.500	12.5	49.6	.496	12.2725	-.2275	-1.82

Comments:

Post Run Audit: By: RLS Time: 1650 Temp: 80 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	.000	00.0	00.0	.000	.0446	+.0446	+0.18
Span	50.0	.500	12.5	49.5	.492	12.1739	-0.3261	-2.61

Comments:

± Conc. Difference = Act % - Exp (Std) %

Zero % Differece = $\frac{\text{Act \% (ppm)} - \text{Exp \% (ppm)}}{\text{Full Scale Value}} \times 100$

Span % Difference = $\frac{\text{Act \% (ppm)} - \text{Exp \% (ppm)}}{\text{Exp \% (ppm)}} \times 100$

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-2

Site: Myren Consulting, Woodinville, WA Date: 9/14/99 Analyte: O_2

Source: Kuma Wood Classic Run #: EPA 3

Zero Cyl #: 719 430 Conc. 00.0 % O_2 Cyl Press: 1950 psi

Certified by: Oxarc Date: 4/1/99

Span Cyl #: 250-794 Conc. 12.5 % O_2 Cyl Press: 1310 psi

Certified by: Oxarc Date: 3/26/99

Analyzer: Make: Taylor Model: OA 137 SN: 137/4772

Range: 0 - 25.0% O_2 Analyzer Output: 0 - 100 mv.

Flow: 1.5 SCFH Measured by: Rotameter: X Flowmeter:

EPA Span Value = 25.0% O_2
EPA Control Limits = + 2.5% of 25.0% O_2 = + 0.625% O_2

Pre Run Audit: By: RLS Time: 1110 Temp: 75 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	00.0	00.0	.0050	+.0050	+0.02
Span	12.5	50.0	12.5	12.5	49.7	12.4158	-.0842	-0.67

Comments:

Post Run Audit: By: RLS Time: 1650 Temp.: 80 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	00.0	00.0	.0050	+.0050	+0.02
Span	12.5	50.0	12.5	12.5	49.5	12.3659	-.1341	-1.07

Comments:

± Conc. Difference = Act % - Exp (Std) %

Zero % Differece = $\frac{\text{Act \% (ppm)} - \text{Exp \% (ppm)}}{\text{Full Scale Value}} \times 100$

Span % Difference = $\frac{\text{Act \% (ppm)} - \text{Exp \% (ppm)}}{\text{Exp \% (ppm)}} \times 100$

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-3

Site: Myren Consulting, Woodinville, WA Date: 9/14/99 Analyte: CO

Source: Kuma Wood Classic Run #: EPA 3

Zero Cyl #: 719 430 Conc. 00.0 % CO Cyl Press: 1850 psi

Certified by: Oxarc Date: 4/1/99

Span Cyl #: 250-794 Conc. 2.5 % CO Cyl Press: 1310 psi

Certified by: Oxarc Date: 3/26/99

Analyzer: Make: Infra Red Model: 702 D SN: 113

Range: 0 - 10.0% CO Analyzer Output: 0 - 100 mv.

Flow: 1.5 SCFH Measured by: Rotameter: X Flowmeter:

EPA Span Value = 5.0% CO

EPA Control Limits = +2.5% of 5.0% CO = + 0.125% CO

Pre Run Audit: By: RLS Time: 1110 Temp: 75 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	0.00	00.0	.0093	-.0093	-0.19
Span	2.50	50.0	2.50	2.50	49.9	2.4864	-0.0136	-0.54

Comments:

Post Run Audit: By: RLS Time: 1650 Temp.: 80 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	0.00	00.1	.0043	-.0043	-0.09
Span	2.50	50.0	2.50	2.41	48.0	2.3914	-.1086	-4.34

Comments:

± Conc. Difference = Act % - Exp (Std) %

$$\text{Zero \% Differece} = \frac{\text{Act \% (ppm)} - \text{Exp \% (ppm)}}{\text{Full Scale Value}} \times 100$$

$$\text{Span \% Difference} = \frac{\text{Act \% (ppm)} - \text{Exp \% (ppm)}}{\text{Exp \% (ppm)}} \times 100$$

Unit: Kuma Wood Classic
Run: EPA 3
Date: 1/14 199
Technicians: ATM / RLS
WST6-Form3-Rev11/89

QUALITY CHECKS
WOODSTOVE DATA SHEET #16

Ambient = Tr: _____ °F T/C#30: _____ °F

Thermocouple Check (at ambient): T/C#1: 65 °F; T/C#2: 65 °F;

T/C #3: 66 °F; T/C #4: 67 °F; T/C #5: 67 °F;
T/C #6: 67 °F; T/C #7: 67 °F; T/C #8: 67 °F;
T/C #9: 66 °F; T/C #10: 66 °F; T/C #11: 67 °F;
T/C #12: 67 °F; T/C #13: 66 °F; T/C #14: 66 °F;
T/C #15: 66 °F; T/C #16: 66 °F; T/C #17: 65 °F;
T/C #18: 66 °F; T/C #19: _____ °F; T/C #20: _____ °F;
T/C #21: _____ °F; T/C #22: _____ °F; T/C #23: _____ °F;
T/C #24: _____ °F; T/C #25: _____ °F; T/C #26: _____ °F;

Comments: _____

Thermocouple Readout: Pretest Zero/Span Check and Calibration:

Zero (0°F) : 001 °F Adj to: 000 °F Post Test Check Zero (0°F): 001 °F % Difference +0.05%

Span (2000°F): 1999 °F Adj to: 2000 °F Span (2000°F): 2000 °F 0

(Allowable % Difference = 1.5%. Use formulas on Woodstove Data Sheet #15 to calculate % Difference)

Thermocouple Readout Pretest Linearity Check

0°F = 000 °F; 200°F = 200 °F; 400°F = 399 °F;
600°F = 600 °F; 800°F = 800 °F; 1000°F = 1001 °F;
1200°F= 1200 °F; 1400°F = 1400 °F; 1600°F = 1599 °F
1800°F= 1800 °F; 2000°F = 2000 °F

Combustion Gas (CO_2,O_2,CO) Train Leak Check: Pre ✓ Post ✓

Draft (Static) Guage Zero Check: Pre ✓ Post ✓

Scale Check Pre (Wt, #'s): 570.8 - 575.8 - 5.0 lbs, OK (RLS)

Post (Wt, #'s): 572.2 - 577.2 - 5.0 lbs, OK (RLS)

Stack cleaned prior to the run: Yes ____ No ✓

Tunnel cleaned prior to the run: Yes ____ No ✓

Becherini Scale Center, Inc.
317 E. Sprague
Spokane, WA 99202

SCALE CALIBRATION RECORD

Customer: MAREN CONSULTING INC | Date: 9/29/99

Work Order Number: 2.18p1 | PO Number:

Equipment Mfg.	Serial Number	Specifications	Weight used	Initial Readings	Final Readings
1. PANTHER	44661599	1K X .1 LB	0	0	
	Pass...Fail		100.0	100.0	
Notes:			200.0	200.0	
			400.0	400.0	
			500.0	500.0	
			0	0	

Equipment Mfg.	Serial Number	Specifications	Weight used	Initial Readings	Final Readings
2. DI-10	830165	1K X .1 LB	0	0	0
	Pass...Fail		100.0	100.0	100.0
Notes:			200.0	200.0	200.0
			400.0	399.8	400.0
			500.0	499.6	500.0
			0	0	0

Equipment Mfg.	Serial Number	Specifications	Weight used	Initial Readings	Final Readings
3.					
	Pass...Fail				
Notes:					

Equipment Mfg.	Serial Number	Specifications	Weight used	Initial Readings	Final Readings
4.					
	Pass...Fail				
Notes:					

Additional Comments:

Last Checked: 3/4/99 | Next Check Due: 3/4p

Weights Certified: | Technician:

Calibration checked IAW NIST handbook 44

Becherini Scale Center, Inc.
317 E. Sprague
Spokane, WA 99202
509-747-0181

SCALE CALIBRATION RECORD

Customer: MIREN CONSULTING, INC. Date: 4 MAR 99

Work Order Number: PO Number:

Equipment Mfg.	Serial Number	Specifications	Weight used	Initial Readings	Final Readings
1. PANTHER	4-M64159-4X4	1000x.1 lb	0	0	
	Pass Fail		100.0	100.0	
Notes:			200.0	200.0	
			300.0	300.0	
			500.0	500.0	
			0	0	

Equipment Mfg.	Serial Number	Specifications	Weight used	Initial Readings	Final Readings
2.					
	Pass...Fail				
Notes:					

Equipment Mfg.	Serial Number	Specifications	Weight used	Initial Readings	Final Readings
3.					
	Pass...Fail				
Notes:					

Equipment Mfg.	Serial Number	Specifications	Weight used	Initial Readings	Final Readings
4.					
	Pass...Fail				
Notes:					

Additional Comments:

Last Checked: 9/98 Next Check Due: 9/99

Weights Certified: Technician:

Calibration checked IAW NIST handbook 44

QUALITY CONTROL SERVICES

LABORATORY AND METROLOGY EQUIPMENT: SALES AND SERVICE

Date: 04/13/1999

Customer: Myren Consulting
512 Williams Lake Road
Colville, WA 99114
Attn: Ben Myren

CERTIFICATE OF CALIBRATION

THE INSTRUMENTS LISTED BELOW HAVE BEEN SERVICED AND CALIBRATED BY QUALITY CONTROL SERVICES ON THE DATE INDICATED. SERVICE CONSISTS OF ACCURACY TESTS, ADJUSTING TO MANUFACTURER OR CUSTOMER SPECIFICATIONS AND COMPLETE CALIBRATION WITH STANDARDS TRACEABLE TO THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (N.I.S.T.).

Item:	Make:	Model:	Serial Number:	Location:	Contact:	Cal. Date:	Cal. Due:
Balance	Mettler	AE100	K04827	Lab	Ben Myren	04/06/1999	09/1999

STANDARDS USED FOR THIS CALIBRATION:

Item:	Make:	Model:	Serial Number:	NIST ID:	Cal. Date:	Cal. Due:
Weight Set	Rice Lake	1MG-20KG	A45	822/251337	07/07/1998	07/1999

Technician: D.Deleasa

Signature D. Deleasa

2340 S.E. 11TH AVENUE • PORTLAND, OREGON 97214
P.O. BOX 14831 • PORTLAND, OREGON 97293 • (503) 236-2712 • FAX: (503) 235-2535

QUALITY CONTROL SERVICES

LABORATORY AND METROLOGY EQUIPMENT: SALES AND SERVICE

DATE: December 04, 1997

CUSTOMER: Myren Consulting
512 Williams Lake Rd.
Colville, WA 99114
Attn: Ben Myren

WEIGHT TRACEABILITY CERTIFICATE

THE BALANCES/SCALES LISTED BELOW HAVE BEEN SERVICED AND CALIBRATED BY QUALITY CONTROL SERVICES.

THIS DOCUMENT CERTIFIES THAT THE TEST WEIGHTS USED ARE TRACEABLE TO THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (N.I.S.T.) UNDER TEST # 822/251337.

QCS Weight Set I.D. Number	Calibration Date	Next Calibration Due
A45	07-02-97	07-98
8543	07-02-97	07-98
5735	07-02-97	07-98
7809	07-02-97	07-98
G782	07-02-97	07-98

DATE OF SERVICE	TYPE	MANUFACTURER	SERIAL NUMBER	TECHNICIAN
12-01-97	AE163	Mettler	K04827	G. Cahill

AUTHORIZED REPRESENTATIVE: G. Cahill

2340 S.E. 11TH AVENUE • PORTLAND, OREGON 97214
P.O. BOX 14831 • PORTLAND, OREGON 97293 • (503) 236-2712 • FAX: (503) 235-2535

DENSITY STANDARD USED FOR TROEMNER PRECISION WEIGHTS

Troemner Inc. adjusts all new weights and all weights received for recalibration on the basis of apparent mass versus material of density 8.0g/cm³ at 20°C. This action is in accordance with the recommendations of the American Society for Testing and Materials specification ANSI/ASTM E 617 and the International Organization of Legal Metrology (OIML) International Recommendation No. 20.

Previously, all weights had usually been adjusted on the basis of apparent mass versus "brass," a hypothetic material of defined density 8.4g/cm³ at 0°C and 8.3909g/cm³ at 20°C. This practice originated in the early 1800's and was adopted in all of the English speaking countries as well as a number of other countries. Now most mass standards and test weights are made from stainless steel (density ranges from 7.77g/cm³ to 8.0g/cm³). A number of countries have adopted the recommendations of OIML and the foremost balance manufacturers are adjusting the built-in weights in their balances on the basis of apparent mass versus 8.0g/cm³. In order to smooth the transition in this country, the Reports of Calibration of the National Bureau of Standards are reporting the corrections to calibrated mass standards on both bases.

In terms of normal weighing procedures the change is very small. For a given weight, the mass value assigned on the basis of apparent mass versus density 8.0g/cm³ material will be 7 parts per million higher than the value assigned on the basis of apparent mass versus "density 8.4g/cm³" material. In many cases the allowed weight adjustment tolerances are so large that this change is immaterial although closely adjusted weights often have a smaller tolerance than the correction change. For example at the 1 kilogram level the change is 7 mg. For comparison the ANSI/ASTM E 617 Class 6 tolerance for 1 kilogram is 100 mg while the Class 1 tolerance is 2.5 mg. A detailed discussion of mass and mass values is given in Reference 3.

Precision Weights manufactured by Troemner Inc. to ASTM Class 1, 1.1, 2, 3, 4, 5, and 6 tolerances and the equivalent OIML and NBS tolerances are of the following materials:

Designation	*Base Material*	*Density*	*Weight Range*
Stainless Steel	18-8	7.84g/cm³ at 20°C	1 g & larger
Stainless Steel	18-8	8.0g/cm³ at 20°C	50 mg to 500 mg
Aluminum	1100	2.7g/cm³ at 20°C	30 mg & smaller

References:

1. ANSI/ASTM E 617
   Available from: Troemner Inc. 6825 Greenway Ave., Phila. Pa. 19142 215-724-0800 or American Society for Testing and Materials, 1916 Race Street, Phila., Pa. 19103
2. OIML INTERNATIONAL RECOMMENDATION No. 20
   Available from: Organisation Internationale De Metrologie Legale 11 Rue Truyot - 75009 Paris, France
3. NBS MONOGRAPH 133, MASS AND MASS VALUES
   Available from: Superintendent of Documents, U.S. Government Printing Office Washington, D.C. 20402 Order by SD Catalog No. C13,44:1331 Stock Number 0303-01178

TROEMNER INC.
Manufacturers of Precision Weights... Mass Standards • Balances • Laboratory Apparatus
6825 Greenway Avenue - Philadelphia, Pa. 19142
215/724-0800

Wts. used for Scale QC Checks, P. 4-4.

WOODSTOVE DATA SHEET #33

Thermocouple Calibration Record

TC #	Location	Ice Water Bath (°F)	Boiling Water (°F)
1	Wet Bulb	32.5	209.7
2	Dry Bulb	32.4	209.8
3	Stack	32.6	209.6
4	Stove Top	32.4	209.8
5	Left Side	32.5	209.7
6	Back	32.5	210.1
7	Right Side	32.6	210.3
8	Bottom	32.5	209.9
9	Firebox	32.6	209.9
	2nd Burn		
10	Catalytic	32.6	209.7
11	Room	32.3	209.8
12	~~Tube Furnace~~ TNL Temp	32.5	210.0
13	~~Sample Box~~ C. Gas Hot Box	32.5	209.7
14	Impinger Out C. Gas	32.4	209.9
15	~~C Gas Box~~ Filter #1	32.3	209.7
16	~~C Gas Out~~ Filter #1 Cond	32.4	209.9
17	~~SO2 Gas Out~~ Filter #2	32.3	209.9
18	~~Extra~~ Filter #2 Cond	32.4	209.8
19	Extra		
20	Extra		

TC #	Location	Ice Water Bath (°F)	Boiling Water (°F)
21			
22			
23			
24			
25			
26			
27			
28			
29	Oven		
30	N/A-Calibrator		
31			
32			
33			
34			
35	Rear Top		
36	Reat L Side		
37	Rear R Side		
38	Rear Firebox		
39	Rear 2nd/cat		
40			

Thermocouples checked against

Reference Thermometer #: ERTCO CAT 1005-3FC CAT 517 SN 1697

Ice Water Bath 32.3 °F

Boiling Water 210.0 °F

Room Temp 72 °F

B.P. 28.495 "Hg

Date: 7/17/99 Technician: A. J. Myren

Range 0-1999°F

Date: 7/17/99 Thermocouple No.: Extech Model 4020 KF

Ambient Temperature: 72 °F Barometric Pressure: 28.495 "Hg

Calibrator: A.T. Myren Reference: Mercury-in-glass: ERTCO SN 1697

Other: Altec

Amb ERTCO 72 72 0

Reference point No.[a]	Source[b] (specify)	Reference thermometer temperature, °F	Thermocouple potentiometer temperature, °F	Difference,[c] %
1	Altec	0	2	+2.43
2	↓	100	102	+0.36
3		200	202	+0.30
4		300	299	-0.13
5		400	399	-0.12
6		500	500	0
7		600	600	0
8		700	698	-0.17
9		800	800	0
10		900	899	-0.07
11		1000	1002	0.14
12		1100	1101	0.06
13		1200	1201	0.06
14		1400	1401	0.05
15		1600	1600	0
16		1800	1799	-0.04
17	↓	1900	1899	-0.04

[a] Every 30°C (50°F) for each reference point

[b] Type of Calibration system used

[c] $\frac{\text{(Ref. temp: °C + 273) - (Test therm. temp. °C + 273}}{\text{Ref. Temp. °C + 273}} \times 100 \leq 1.5\%$

Stack Temperature Sensor Calibration Data Sheet

Range 0- /SN 900167

Date: 7/17/99 Thermocouple No.: Jenco Model 768- F-02

Ambient Temperature: 72 °F Barometric Pressure: 28.495 "Hg

Calibrator: A.T. Myren Reference: Mercury-in-glass: Ertco SN 1697

Other: Altec

Amb Ertco 72 72 0/Meter Box 511M

Reference point No.[a]	Source[b] (specify)	Reference thermometer temperature, °F	Thermocouple potentiometer temperature, °F	Difference,[c] %
1	Altec	0	0	0
2	↓	100	99	-,16
3		200	201	+.15
4		300	299	-0.13
5		400	398	-0.23
6		500	497	-0.31
7		600	597	-0.29
8		700	697	-0.26
9		800	800	0
10		900	901	+0.07
11		1000	1006	+0.41
12		1100	1108	+0.51
13		1200	1211	+0.66
14		1400	1420	+1.03
15		1600	1616	+0.78
16		1800	1811	+0.49
17	↓	2000	1999	-0.04

[a] Every 30°C (50°F) for each reference point

[b] Type of Calibration system used

[c] $\frac{\text{(Ref. temp: °C + 273) - (Test therm. temp. °C + 273}}{\text{Ref. Temp. °C + 273}} \times 100 \leq 1.5\%$

Stack Temperature Sensor Calibration Data Sheet

Meter Box 45G-P Omega Model 115KF

Date: 7/17/99 Thermocouple No.: SN 84487KF Range 0-2000°

Ambient Temperature: 72 °F Barometric Pressure: 28.495 "Hg

Calibrator: A.T. Myren Reference: Mercury-in-glass: Ertco SN 1697

Other: Altec

Ambient Ertco 72 72 0

Reference point No.[a]	Source[b] (specify)	Reference thermometer temperature, °F	Thermocouple potentiometer temperature, °F	Difference,[c] %
1	Altec	0	0	0
2		100	99	-.18
3		200	201	+.15
4		300	301	+.13
5		400	400	0
6		500	500	0
7		600	601	+0.09
8		700	700	0
9		800	800	0
10		900	901	+0.07
11		1000	1001	+.07
12		1100	1100	0
13		1200	1201	+.06
14		1400	1400	0
15		1600	1601	+0.05
16		1800	1801	+0.04
17	↓	2000	1999	-0.04

[a] Every 30°C (50°F) for each reference point

[b] Type of Calibration system used

[c] $\frac{\text{(Ref. temp: °C + 273) − (Test therm. temp. °C + 273}}{\text{Ref. Temp. °C + 273}} \times 100 \leq 1.5\%$

Stack Temperature Sensor Calibration Data Sheet

ALTEK

CERTIFICATE OF CALIBRATION

This is to Certify that your Altek Unit has been calibrated using standards whose accuracies are traceable to the National Institute of Standards and Technology (formerly NBS) within the limits of the NIST Calibration Services. Actual records pertaining to these standards are on file and are available for examination.

Certified by: Altek Industries Corp.
Recommend Recalibration: Annually

In service date 4/11/96

Model K2100F Serial No. Serial # 177533

T. Krech
Calibration Technician

31 AUG 95
Factory Calibration Date

ALTEK INDUSTRIES CORP
210 Commerce Drive, Rochester, NY 14623 U.S.A.
(716) 334-3720 FAX: (716) 334-6673
800-32-ALTEK
800-322-5835
Anywhere in USA

EVER READY THERMOMETER CO., INC.
228 LACKAWANNA AVENUE
WEST PATTERSON, NJ 07424
(201) 812-7474

R E P O R T O F C A L I B R A T I O N

LIQUID-IN-GLASS-THERMOMETER

CALIBRATED BY EVER READY THERMOMETER CO.

MARKED: ERTCO CAT 1005-3FC S/N-1697
RANGE: -1 TO +101 DEGREES C IN 0.1 DEGREE GRADUATIONS.

THERMOMETER READING	CORRECTION (ITS-90)**
0.00 C	0.00 C
10.00	0.00
20.00	0.00
30.00	0.00
37.00	0.00
40.00	0.00
50.00	0.00
56.00	0.00
60.00	0.02
70.00	0.00
80.00	0.00
90.00	0.00
100.00	0.00

** ALL TEMPERATURES IN THIS REPORT ARE BASED ON THE INTERNATIONAL TEMPERATURE SCALE OF 1990 (ITS-90) PUBLISHED IN THE METROLGIA 27, NO. 1, 3/10/90.

THIS THERMOMETER WAS CALIBRATED AGAINST A STANDARD CALIBRATED AT THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST) FORMERLY THE NATIONAL BUREAU OF STANDARDS (NBS) IN ACCORDANCE WITH ASTM METHOD E 77, AND NBS MONOGRAPH 174.

FOR A DISCUSSION OF ACCURACIES ATTAINABLE WITH SUCH THERMOMETERS SEE NBS MONOGRAPH 250-23.

IF NO SIGN IS GIVEN ON THE CORRECTION, THE TRUE TEMPERATURE IS HIGHER THAN THE INDICATED TEMPERATURE; IF THE SIGN GIVEN IS NEGATIVE, THE TRUE TEMPERATURE IS LOWER THAN THE INDICATED TEMPERATURE. TO USE THE CORRECTIONS PROPERLY, REFERENCE SHOULD BE MADE TO THE NOTES GIVEN BELOW.

CONTINUED

TEST NUMBER: 152439
DATE: 07/16/96
STANDARD SERIAL NO. 128239
NIST IDENTIFICATION NO. 88024

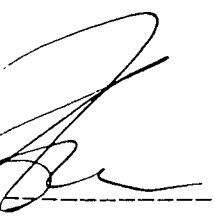
R E P O R T O F C A L I B R A T I O N

LIQUID-IN-GLASS-THERMOMETER

THE THERMOMETER WAS TESTED IN A LARGE, CLOSED-TOP, ELECTRICALLY HEATED, LIQUID BATH, BEING "IMMERSED" 76MM. THE TEMPERATURE OF THE ROOM WAS ABOUT 25 DEGREES C (77 DEGREES F). IF THE THERMOMETER IS USED UNDER CONDITIONS WHICH WOULD CAUSE THE AVERAGE TEMPERATURE OF THE EMERGENT LIQUID COLUMN TO DIFFER MARKEDLY FROM THAT PREVAILING IN THE TEST, APPRECIABLE DIFFERENCES IN THE INDICATIONS OF THE THERMOMETER WOULD RESULT.

THE TABULATED CORRECTIONS APPLY PROVIDED THE ICE-POINT READING, TAKEN AFTER EXPOSURE FOR NOT LESS THAN 3 DAYS TO A TEMPERATURE OF ABOUT 20 DEGREES C (70 DEGREES F) IS 0.00 DEGREES C. IF THE ICE-POINT READING IS FOUND TO BE HIGHER (OR LOWER) THAN STATED, ALL OTHER READINGS WILL BE HIGHER (OR LOWER) TO THE SAME EXTENT. IF THE THERMOMETER IS USED AT A GIVEN TEMPERATURE SHORTLY AFTER BEING HEATED TO A HIGHER TEMPERATURE. AN ERROR OF 0.01 DEGREES OR LESS, FOR EACH 10 DEGREE DIFFERENCE BETWEEN THE TWO TEMPERATURES, MAY BE INTRODUCED. THE TABULATED CORRECTIONS APPLY IF THE THERMOMETER IS USED IN THE UPRIGHT POSITION; IF USED IN A HORIZONTAL POSITION, THE INDICATIONS MAY BE A FEW HUNDREDTHS OF A DEGREE HIGHER.

TEST NUMBER: 152439
DATE: 07/16/96
STANDARD SERIAL NO. 128239
NIST IDENTIFICATION NO. 88024



Charles Tang-Nian
QUALITY CONTROL MANAGER

Thermometer Calibrations

MFR	ERTCO	ERTCO	VWR	Fisher	Taylor	Taylor	Premium	Weston
CAT #	1005-3FC	517	61016-015USA	ASTM-59F	1330NA	1330NA		
SN	1697	K85-163-	—	A04544	WB	DB	A1	
RANGE	-1 to 101°C	0-260°C	-30-50°C	0-180°F	20-120°F	20-120°F	0-220°F	-40-160°F
GRADUATIONS:	0.1°C	1.0°C	1.0°C	1°F	1°F	1°F	1°F	2°F
TYPE	Tube	Tube	Tube	Tube	Tube	Tube	Dial	Dial
TEMP PT. 1	22.1	22	22	72	72	71.5	71	71
2	27.1	27	27	81	81	80.5	80	80
3	7.1	7.0	7.0	45	46	46	45	45
4	0.1	0.5	0.5	32	32	32	33	31
5	98.5	98	—	—	—	—	210	—

$°F = (°C \times 9/5) + 32$

$°C = (°F - 32)\ 5/9$

Drying Oven

A.T. Myren
7/17/99

Note: Taylor 1330 NA WB & DB = thermometers in the sling psychrometer.

DRY GAS METER CALIBRATION DATA

Date 7/12/11 Calibration Meter # 300392 Console Leak Check Front _____

Y = 1.01497 Back _____

Meter Box # 511 M Barometric Pressure, Bp = 28.495 Pitot Leak Check N/A

Calibrated by A.T.Hyatt Dry Gas Meter # 511 M Electrical Check ok

Orifice (dH) in. H20		Gas Volume		Temperature				Time (θ), min.
						Dry Gas Meter		
		Cal. Meter (Vc), cu.ft.	Dry Gas Meter (Vm), cu.ft.		Cal. Meter (Tc), F	Inlet (Tmi), F	Outlet (Tmo), F	
.50	init.	571.842	504.600	init.	79	83 85	84 92	12:58.09
.50	final	577.152	509.900	final	91 93	87	94	
.50	total	5.310	5.300	avg.	91 (541)	84.33	544.33	
.75	init.	577.855	510.600	init.	83 84	87 88	84 85	10:01
.75	final	582.843	515.601	final	85	89	85	
.75	total	4.988	5.001	avg.	84 (544)	88.33	546.33	544.07
1.00	init.	583.536	516.300	init.	36 37	89 89	86 86	9:08.62
1.00	final	588.915	521.704	final	37	90	87	
1.00	total	5.377	5.404	avg.	546.7		547.83	
1.25	init.	589.605	522.400	init.	88 88	89 90	87 87	8:02.57
1.25	final	594.976	527.704	final	89	90	97	
1.25	total	5.371	5.304	avg.	548.3		548.3	
1.50	init.	595.857	528.700	init.	89 89	90 91	87 88	7:11.22
1.50	final	601.032	533.905	final	89	91	88	
1.50	total	5.175	5.205	avg.	549		549.17	7.187

$$Y = \frac{Y\ Vc\ Pb(Tm + 460)}{Vd(Pb + dH/13.6)\ (Tc + 460)}$$

$$dH@ = \frac{0.0317\ dH}{Pb(Tmo + 460)}\left[(Tc + 460)\ \theta/Vc\right]^2$$

$$Y = \frac{(Y_w)(V_w)(P_b)(T_d)}{(V_d)(P_b + \frac{\Delta H}{13.6})(T_w)}$$

$$Y = \frac{(1.01437)(5.310)(28.495)(544.33)}{(5.300)(28.495 + \frac{.50}{13.6})(541)} = \frac{83,536.447}{81,209.109} = 1.0217$$

$$Y = \frac{(1.01437)(4.993)(28.495)(546.33)}{(5.001)(28.495 + \frac{.75}{13.6})(544)} = \frac{78,806.333}{77,671.931} = 1.0146$$

$$Y = \frac{(1.01437)(5.377)(28.495)(547.83)}{(5.404)(28.495 + \frac{1.00}{13.6})(546.7)} = \frac{85,135.352}{84,401.95} = 1.0093$$

$$Y = \frac{(1.01437)(5.371)(28.495)(543.3)}{(5.304)(28.495 + \frac{1.25}{13.6})(548.3)} = \frac{85,163.297}{83,135.977} = 1.0244$$

$$Y = \frac{(1.01437)(5.175)(28.495)(549.17)}{(5.205)(28.495 + \frac{1.50}{13.6})(549)} = \frac{82,135.196}{81,740.915} = 1.0054$$

Y		Variation	Allowed ±0.02
1.0217	$\bar{Y}$ = 1.01508	+.0066	
1.0146	= 1.0151	-.0005	
1.0093		-.0058	
1.0244		+.0093	
1.0054		-.0097	

$$\Delta H @ = \frac{(.0317)(\Delta H)}{(Pb)(T_{md})} \cdot \left[\frac{(T_w)(\Theta)}{(Y_w)(V_w)}\right]^2$$

$$\Delta H @ = \frac{(.0317)(0.5)}{(28.495)(543.67)} \cdot \left[\frac{(541)(12.97)}{(1.01437)(5.10)}\right]^2 = 1.7346$$

$$\Delta H @ = \frac{(.0317)(2.5)}{(28.495)(544.67)} \cdot \left[\frac{(544)(10.03)}{(1.01437)(4.988)}\right]^2 = 1.7761$$

$$\Delta H @ = \frac{(.0317)(1.00)}{(28.495)(546.33)} \cdot \left[\frac{(546.2)(9.16)}{(1.01437)(5.377)}\right]^2 = 1.7148$$

$$\Delta H @ = \frac{(.0317)(1.25)}{(28.495)(547)} \cdot \left[\frac{(548.3)(8.04)}{(1.01437)(5.371)}\right]^2 = 1.6628$$

$$\Delta H @ = \frac{(.0317)(1.50)}{(28.495)(547.67)} \cdot \left[\frac{(549)(7.187)}{(1.01489)(5.175)}\right]^2 = 1.7197$$

$\Delta H @$	Variation (Allowed ± 0.2)
1.7346	+ 0.0130
1.7761	+ 0.0545
1.7148	− 0.0068
1.6628	− 0.0588
1.7197	− 0.0019

$\bar{X} = 1.7216$

Post Test
Meter Box Audits
Woodstove Data Sheet #32

Unit: Kuma Wood Classic
Date: 9/19/99
Technician: A.T. Murew
WST9-Form2, Rev12/88

METER BOX CALIBRATION AUDIT

Test Data

Run #	1	2	3	4	5	6	7	8	9	10
Avg. Δ H	.900	.900	.900	.900	.900	.900	.900			
Max Vac	0	0	0	0	0	0	0			

Avg. Test Series Δ H: .900 in H_2O. Test Series Max Vac: 0 in Hg

Audit Dry Gas Meter: 300392 Correction (Y) Factor: 1.01487
Test Dry Gas Meter: 511 M Correction (Y) Factor: 1.0151

Audit Data

		Audit #1	Audit #2	Audit #3
BP:		28.70	28.705	28.705 "Hg
Vac:		0	0	0
Audit Meter:	Final Vol	735.183	741.040	747.539
	Initial Vol	730.045	735.958	742.400
	Vol (Vw, ft^3)	5.138	5.082	5.139
Audit Meter: Temp (°F)(Tw)	Initial	66	67	68
	Mid	67	68	69
	Final	67	68	69
	Avg (°F/°A)	(66.7) 526.7	(67.7) 527.7	(68.7) 528.7
Δ H (in H_2O)	Initial	.900	.900	.900
	Mid	.900	.900	.900
	Final	.900	.900	.900
	Avg	0.900	.900	.900
Dry Gas Meter:	Final Vol	254.500	260.084	265.526
	Initial Vol	249.100	254.800	260.300
	Vol (V_d, ft^3)	5.400	5.284	5.226
Dry Gas Meter Temp (°F): Inlet	Initial	64	70	74
	Mid	68	73	77
	Final	71	75	77
	Avg (°F/°A)	(67.7) 527.7	(72.7) 532.7	(76) 536
Dry Gas Meter Temp (°F): Outlet	Initial	63	66	67
	Mid	64	67	69
	Final	66	67	70
	Avg (°F/°A)	(64.3) 524.3	(66.7) 526.7	(68.7) 528.7
Avg Dry Gas Meter Temp (Tm-°F/°A)		(66) 526.0	(69.7) 529.7	(72.4) 532.4
Time (minutes)		10:48:13	10:00:37	10:00:68

$Y = \frac{(Vw)(MCF)(BP)(Tm)}{(Vd)(BP + \frac{\Delta H}{13.6})(Tw)}$ Y Factor % Difference = $\frac{Act - Exp}{Exp} \times 100$

NOTE: MCF = Meter Correction (Y) Factor for Dry Gas Meter used as a Transfer Standard

Run 1 $Y = \frac{(5.138)(1.01487)(28.70)(526)}{(5.400)(28.70 + \frac{.900}{13.6})(526.7)} = \frac{78,717.656}{81,816.184} = 0.9621$

$\Delta\% = \frac{(0.9643 - 1.01142)}{1.01142} \times 100 = -4.88\ \%$

Run 2 $Y = \frac{(5.082)(1.01487)(28.705)(529.7)}{(5.284)(28.705 + \frac{.900}{13.6})(527.7)} = \frac{78,421.040}{80,224.593} = 0.9775$

$\Delta\% = \frac{(0.9775 - 1.01142)}{1.01142} \times 100 = -3.35\ \%$

Run 3 $Y = \frac{(5.139)(1.01487)(28.705)(532.4)}{(5.226)(28.705 + \frac{.900}{13.6})(528.7)} = \frac{79,704.828}{79,494.364} = 1.0026$

$\Delta\% = \frac{(1.0026 - 1.01487)}{1.01142} \times 100 = -0.87\ \%$

NOTE: The Y Factor % Difference must be < ±5.0% to be acceptable

Determination of Interpolated Y Factor for Average Certification Test Series Delta H from Dry Gas Meter Calibration Data: $\overline{X} = 3.033\%$

$\frac{0.75}{(A)}$ inch H_2O Delta H = $\frac{1.0146}{(C)}$ Calculated Calibration Y Factor (from Calibrations)

$\frac{1.00}{(B)}$ inch H_2O Delta H = $\frac{1.0093}{(D)}$ Calculated Calibration Y Factor (from Calibrations)

$\frac{1.00}{(B)} - \frac{.75}{(A)} = \frac{.25}{} \times 100 = \frac{25}{(E)}$

$\frac{1.0093}{(D)} - \frac{1.0146}{(C)} = -.0053 \div \frac{25}{(E)} = \frac{.000212}{(F)}$

$\frac{.900}{\text{Avg Delta H}} - \frac{.75}{(A)} = \frac{0.150}{} \times 100 = \frac{15}{(G)}$

$\left[\frac{-.000212}{F} \times \frac{15}{G}\right] + \frac{1.0146}{C} = \frac{1.01142}{\text{Interpolated Y Factor For Avg. Test Series Delta H}}$

Volume Metering System Leak Check: .003 cfm @ 2-1/2 inch H_2O in one minute

REFERENCE METER CALIBRATION
TWO POINT VERIFICATION CHECK
ENGLISH REFERENCE METER UNITS
DGM Serial # 308592
Date 7/19/99

Filename: F:\DATAFILE\CALIBRAT\CAL_MENU.DBF\DGM_2VER\TEMPLAT
Revised: 1/5/98

Barometric Pressure 29.86
Meter Yw 1.00000
K (deg R/inches Hg) 17.64

Time (min)	Pressure (in. H20)	Dry Gas Meter (DGM) Meter Readings Initial	Final	Volume (cubic feet)	Temperature Initial (deg F)	Final (deg F)	Wet Test Meter (WTM) Meter Readings Initial	Final	Volume (cubic feet)	Temp (deg F)	DGM Coefficient Yds	Flow Rate (CFM)	PREVIOUS DATA DGM Coefficient Yds
20.00	-5.200	655.802	675.745	19.943	81.0	80.0	679.930	699.525	19.595	82.0	0.993	0.950	1.004
												%CHANGE	1.1388157 %
15.00	-2.000	649.460	655.802	6.342	80.0	81.0	673.570	679.930	6.360	82.0	1.005	0.411	1.006
												%CHANGE	0.0971685 %

%CHANGE MUST BE +/- 1.5%, ELSE PERFORM 15PT CAL

I certify that the above Dry Gas Meter was calibrated in accordance with E.P.A. Method 5 , paragraph 7.1 ;CFR 40 Part 60, using the Precision Wet Test Meter # 11AE6, which in turn was calibrated using the American Bell Prover # 3785, certificate # F107, which is traceable to the National Bureau of Standards (N.I.S.T.).

Signature _____ Date 7-19-99

REFERENCE METER CALIBRATION
TWO POINT VERIFICATION CHECK
ENGLISH REFERENCE METER UNITS
DGM Serial # 300392
Date 7/26/98

Filename: F:\DATAFILE\CALIBRAT\CAL_MENU.DSK\DGM_2VER\300392-
Revised: 1/5/98

Barometric Pressure 29.71
Meter Yw 1.00000
K (deg R/inches Hg) 17.64

		Dry Gas Meter (DGM)			Temperature		Wet Test Meter (WTM)						PREVIOUS DATA
Time (min)	Pressure (in. H20)	Meter Readings Initial	Final	Volume (cubic feet)	Initial (deg F)	Final (deg F)	Meter Readings Initial	Final	Volume (cubic feet)	Temp (deg F)	DGM Coefficient Yds	Flow Rate (CFM)	DGM Coefficient Yds
10.00	-5.000	417.848	427.852	10.004	80.0	81.0	578.155	588.070	9.915	80.0	1.004	0.962	1.009
												%CHANGE	0.4509415 %
20.00	-1.800	427.852	436.302	8.450	81.0	82.0	588.070	596.510	8.440	80.0	1.006	0.410	1.013
												%CHANGE	0.6838462 %

%CHANGE MUST BE +/- 1.5%, ELSE PERFORM 15PT CAL

I certify that the above Dry Gas Meter was calibrated in accordance with E.P.A. Method 5 , paragraph 7.1 ;CFR 40 Part 60, using the Precision Wet Test Meter # 11AE6, which in turn was calibrated using the American Bell Prover # 3785, certificate # F107, which is traceable to the National Bureau of Standards (N.I.S.T.).

Signature _____ Date 7-26-98

REFERENCE METER CALIBRATION
ENGLISH REFERENCE METER UNITS

Barometric Pressure 29.55
Meter Yw 1.00000
K (deg R/inches Hg) 17.64

DGM Serial # 300392
Date 4/17/97

Filename: F:\DATAFILE\CALIBRAT\CAL_MENU.DSK\DGM_REF.
Revised: 06/08/95

Time	Pressure	Dry Gas Meter (DGM) Meter Readings		Volume	Temperature Initial	Final	Wet Test Meter (WTM) Meter Readings		Volume	Temp	DGM Coefficient	Coefficient Variation	Flow Rate
(min)	(in. H20)	Initial	Final	(cubic feet)	(deg F)	(deg F)	Initial	Final	(cubic feet)	(deg F)	Yds	Yds-(Avg.Yds)	(CFM)
43.50	-6.800	975.414	1027.032	51.618	74.0	75.0	570.631	621.609	50.978	70.0	1.013	0.000	1.153
5.00	-6.800	27.032	33.092	6.060	75.0	76.0	621.609	627.579	5.970	70.0	1.013	0.000	1.174
5.50	-6.800	33.092	39.759	6.667	76.0	76.0	627.579	634.140	6.561	70.0	1.012	0.000	1.173
									Max Yds - Min Yds =0.000757781		Must be no greater than 0.030		
									Average Yds =1.012668100		Must be between 0.95 to 1.05		
21.00	-4.600	39.759	59.519	19.760	76.0	76.0	634.140	653.669	19.529	70.0	1.011	0.001	0.915
8.00	-4.600	59.519	67.033	7.514	76.0	76.0	653.669	661.070	7.401	70.0	1.008	-0.002	0.910
6.50	-4.600	67.033	73.137	6.104	76.0	77.0	661.070	667.091	6.021	70.0	1.010	0.000	0.911
									Max Yds - Min Yds =0.003425424		Must be no greater than 0.030		
									Average Yds =1.009592597		Must be between 0.95 to 1.05		
35.00	-3.000	73.137	99.630	26.493	77.0	76.0	667.091	693.309	26.218	70.0	1.009	-0.003	0.737
11.50	-3.000	99.630	108.357	8.727	70.0	72.0	693.309	702.130	8.821	74.0	1.013	0.000	0.749
17.50	-3.000	108.357	121.465	13.108	72.0	72.0	702.130	715.389	13.259	74.0	1.015	0.003	0.740
									Max Yds - Min Yds =0.006019406		Must be no greater than 0.030		
									Average Yds =1.012417828		Must be between 0.95 to 1.05		
11.50	-2.000	121.465	127.641	6.176	72.0	73.0	715.389	721.703	6.314	74.0	1.025	-0.002	0.536
28.00	-2.000	127.641	142.554	14.913	73.0	75.0	721.703	736.961	15.258	74.0	1.028	0.002	0.532
10.00	-2.000	142.554	147.894	5.340	75.0	76.0	736.961	742.395	5.434	74.0	1.026	-0.001	0.530
									Max Yds - Min Yds =0.003679685		Must be no greater than 0.030		
									Average Yds =1.026129451		Must be between 0.95 to 1.05		
27.50	-1.400	147.894	159.237	11.343	76.0	77.0	742.395	753.825	11.430	74.0	1.016	0.002	0.406
22.50	-1.400	159.237	167.914	8.677	77.0	79.0	753.825	762.519	8.694	74.0	1.013	-0.001	0.377
16.00	-1.400	167.914	174.098	6.184	79.0	80.0	762.519	768.690	6.171	74.0	1.012	-0.002	0.376
									Max Yds - Min Yds =0.004226433		Must be no greater than 0.030		
									Average Yds =1.013540053		Must be between 0.95 to 1.05		

Overall Average Yds =1.014869606

I certify that the above Dry Gas Meter was calibrated in accordance with E.P.A. Method 5 , paragraph 7.1 ;CFR 40 Part 60, using the Precision Wet Test Meter # 11AE6, which in turn was calibrated using the American Bell Prover # 3785, certificate # F107, which is traceable to the National Bureau of Standards (N.I.S.T.).

Signature _____ Date 4-17-97

VANEOMETER CALIBRATION

Myren Consulting uses a Dwyer Model #480 Vaneometer to measure test chamber air velocity. The manufacturer's specifications for accuracy are ±5.0% to 100 FPM and ±10% from 100 FPM to top of scale. Myren Consulting insures that the instrument is level and clean prior to taking each reading. According to EPA personnel (Westlin, RTP) no further calibration of the instrument is necessary.

DRAFT GAUGE CALIBRATION

Myren Consulting uses a Dwyer Model 115-AV 0 - 0.25" inclined water manometer (readibility resolution ±0.001" of water) to measure the static pressure in the stack. Once leveled and zeroed as per the manufacturer's written operating instructions, the Dwyer 0 - 0.25" manometer is a primary standard and needs no additional calibration.

The manometer is leveled and zeroed at the start of each test run, checked as necessary during the run to verify that the settings have not changed and again at the end of each test run. The results of each check are recorded on Woodstove Data Sheet #16 in each individual test run.

BAROMETER CALIBRATION

Myren Consulting uses a Weems and Plath aneriod barometer to measure barometric pressure (BP) in the Woodinville, WA lab. The barometer is calibrated daily by obtaining the barometeric pressure (station pressure) from the National Weather Service (NWS) adjusting that pressure for altitude and then calibrating the lab barometer as necessary to that pressure.

MOISTURE METER CALIBRATION

The Delmhorst Model RC-1E, SN 1509 Moisture Meter is calibrated each time the meter is turned on using the two (2) calibration settings (Zero and Span). The potentiometers for each calibration point (X = Zero, Y = Span) are adjusted until the meter is correctly calibrated. Then the operation of the meter is checked in the normal operating range used during testing (11 - 25%) with a Delmhorst Model MCS-1 Moisture Content Standard at 12.5% and 22%.

Myren Consulting has a second moisture meter - Delmhorst Model RDX-1 SN 1359 - to use as a backup and as means of checking the readings on the Model RC-1E.

The readings obtained from the moisture meter are corrected as per the manufacturer's wriiten instructions. See the following page for the correction table used to correct the readings.

10.0 - 10.6
10.5 - 11.2
11.0 - 11.7
11.5 - 12.3
12.0 - 12.8
12.5 - 13.3
13.0 - 13.9
13.5 - 14.4
14.0 - 14.9
14.5 - 15.4
15.0 - 15.9
15.5 - 16.5
16.0 - 17.0
16.5 - 17.5
17.0 - 18.1
17.5 - 18.6
LEGAL ↑
18.0 - 19.2
RANGE
18.5 - 19.8
19.0 - 20.3
19.5 - 20.9
20.0 - 21.4
20.5 - 22.0
21.0 - 22.6
21.5 - 23.1
22.0 - 23.7
22.5 - 24.3
↓ 23.0 - 24.9
23.5 - 25.4
24.0 - 26.0
24.5 - 26.6
25.0 - 27.2

26-ED ELECTRODE

OPERATING INSTRUCTIONS

The 26-E and 18-E Electrodes, fitted with insulated pins and used with any Delmhorst Moisture Detectors for Wood, are available in detecting moisture gradient in lumber or in testing dry stock that is wet on the surface.

These Electrodes, as long as they have good insulation on their shanks, measure moisture content at the tip of the pins only, that is in a layer about 3/16" thick.

Shell and core, moisture content is easily measured by driving the pins to the proper depths.

When using the Electrode, place the pins on the wood so that the current will flow parallel to the grain and drive the pins into the wood by means of the sliding hammer. Note the pins' penetration, and read the meter.

The Moisture Meter is calibrated for use with a 4-pin Electrode. When using a 2-pin Electrode, a small correction should be applied, as noted below, where line "A" shows meter readings, and line "B" the correct readings for the 2-pin Electrode.

A=	7	8	10	12	14	16	18	20	22
B=	7.3	8.4	10.6	12.8	14.9	17.0	19.2	21.4	23.7

When the insulation on the contact pins wears off, the above correction should be disregarded, and the electrode should not be used on lumber which may have a wet surface. Always use the L-319 insulating washer especially if surface moisture on the wood is expected. If washers are not available, do not allow the retainers to touch the surface of the wood.

DELMHORST
INSTRUMENT CO.
INDIAN LANE EAST, TOWACO, NJ 07082. TEL: 201-334-2557. FAX. 201-334-2657. CALL US TOLL FREE AT 800 222-0638

WOODSTOVE DATA SHEET #26-A

CEM GAS TRAIN RESPONSE TIME

PRE CERTIFICATION TEST SERIES CHECK

Date	7/17/99	7/17/99	7/17/99	7/17/99	7/17/99	7/17/99	7/17/99	7/17/99	7/17/99		
Technicians	ATM	ATM	ATM	ATM	ATM	ATM	ATM	ATM	ATM		
Elapsed Time	CO_2 Conc.(V)	CO_2 Conc.(V)	CO_2 Conc.(V)	CO Conc.(V)	CO Conc.(V)	CO Conc.(V)	O_2 Conc.(V)	O_2 Conc.(V)	O_2 Conc.(V)	Conc.(V)	Conc.(V)
0 Seconds	.309	.308	.306	.98	.99	1.03	51.3	51.5	51.8		
15	.308	.307	.305	.98	.99	1.03	51.2	51.5	51.7		
30	.047	.045	.043	.09	.10	.11	81.2	81.5	81.4		
45	.021	.020	.019	.08	.08	.08	82.5	82.9	82.7		
60	.011	.010	.010	.06	.07	.06	83.8	84.0	83.9		
75	.008	.009	.008	.05	.06	.04	84.3	84.6	84.5		
90	.006	.007	.007	.04	.05	.04	84.4	84.7	84.6		
105	.004	.006	.005	.03	.05	.03	84.5	84.6	84.7		
120	.002	.005	.004	.03	.04	.03	84.6	84.6	84.7		
135	.002	.004	.003	.02	.03	.02	84.7	84.7	84.7		
150	.001	.003	.002	.01	.02	.01	84.7	84.7	84.8		
165	.001	.002	.001	.01	.01	.01	84.7	84.7	84.7		
180	.001	.001	.001	.00	.01	.01	84.7	84.8	84.8		
Initial Response Time (Seconds)	N 15	N 15+	N 15+	N 15-20	N 15-20	N 15-20	N 20	N 20	N 20		
95% Response Time (Seconds)	>45<60	>45<60	>45<60	>75<90	>75<90	>60<75	>45<60	>45<60	>45<60		
Analyzer Flow Rate 1.5SCFH	←	→	1.5SCFH	←	→		1500 cc/min		→		

Comments

95%= .015 .015 .015 .049 .050 .050 82.84 83.04 83.06

Clean Train & Filters

InterMountain Ambient
P.O. Box 5106 ☐ Missoula, MT 59806 ☐ (406) 543-6174

Pre Kuma Wood Classic

QA WS 1/85

CO_2 ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Site: Colville, WA 99114 Date: 9/11/99

Analyzer: Make: HORIBA Model: PIR2000 SN: 607204

Calibration by: A.T. Myren

Cal Gas Flow: 1.5SCFH Measured by: Rotameter: ✓ Mass Flowmeter: ___
BP: 28.78" Hg Instrument ID: Weems
Temp: 80°F Instrument ID: Tenco

Analyzer last calibrated: 7/30/99 By: A.T. Myren

Cylinders:

1. # 719430 Concentration: 0.00 % CO_2 Cyl. Press.: 1860 psi.
   Certified by: Oxarc Date: 4/1/99
2. # 250-794 Concentration: 12.5 % CO_2 Cyl. Press.: 1330 psi.
   Certified by: Oxarc Date: 3/26/99
3. # 250-1175 Concentration: 21.0 % CO_2 Cyl. Press.: 1380 psi.
   Certified by: Oxarc Date: 8/22/97
4. # 250-1060 Concentration: 6.0 % CO_2 Cyl. Press.: 1350 psi.
   Certified by: Oxarc Date: 8/22/97

Analyzer: Calibrated Range. 0-25.0 % Output: 0-1.0 v.

Flow: 1.5SCFH Measured by: Rotameter: X Mass Flowmeter: ___

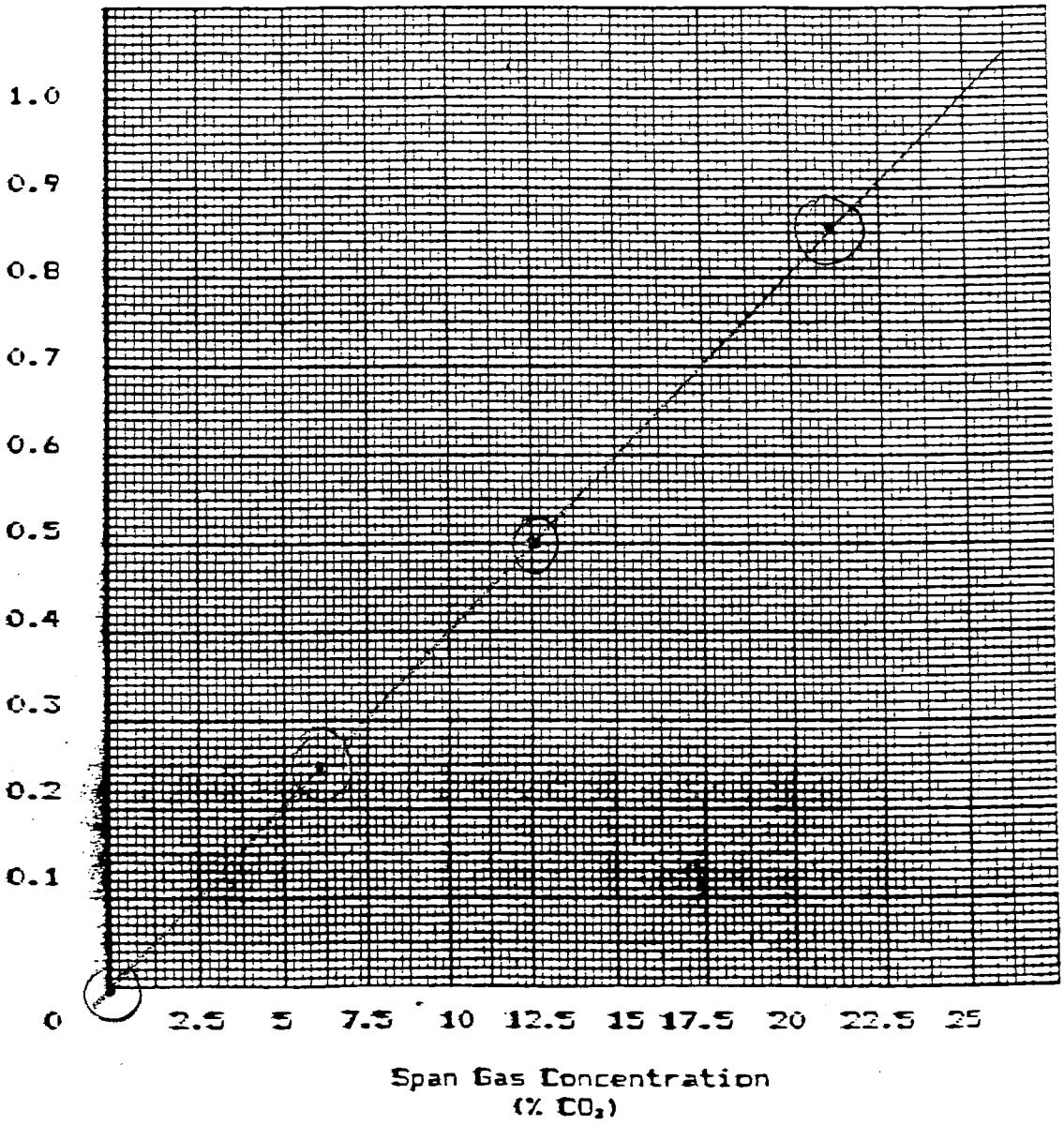
Calibration Results

Point #	Cyl. #	% CO_2	Expected Meter	Expected DVM	Actual Meter	Actual DVM	Adj. Meter	Adj. DVM	% Dif.	Potentiometer Unadj.	Potentiometer Adj.	
1	1	00.0	00.0	.000	.000	-.001	.000	.000	—	6.56	6.65	
2	2	12.5	50.0	.500	50.8	.513	49.75	.500	—	2.67	2.38	
3	3	21.0	84.0	.840	85.0	.853	—	—	+0.35	—	—	21.074
4	4	6.0	24.0	.240	24.0	.242	—	—	+0.18	—	—	6.011
5	1	00.0	00.0	.000	00.0	.000	—	—	0	—	—	

Comments: .500 = 12.3711272

Linear Regression Results:

Y = MX + B
Slope (M) = 24.6506613
Y Intercept (B) = 0.04555
Correlation Coefficient (r) = 0.9979504



Comments

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P.O. Box 5106 ☐ Missoula, MT 59806 ☐ [406] 543-6174

Pre Kuna Wood Classic QA WS 1/85

O_2 ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Site: Colville, WA 99114 Date: 9/11/99

Analyzer: Make: TAYLOR Model: OA 137 SN: 137/4772

Calibration by: A.T. Myren

Cal Gas Flow: 1500 cc/min Measured by: Rotameter: ✓ Mass Flowmeter: ____
BP: 24.78" Hg Instrument ID: Weems
Temp: 80°F Instrument ID: Inco

Analyzer last calibrated: 7/30/99 By: A.T. Myren

Cylinders:

1. # 719430 Concentration: 0.00 % O_2 Cyl. Press.: 1860 psi.
   Certified by: Oxarc Date: 4/1/99
2. # 250-794 Concentration: 12.5 % O_2 Cyl. Press.: 1330 psi.
   Certified by: Oxarc Date: 3/26/99
3. # 250-1175 Concentration: 21.0 % O_2 Cyl. Press.: 1380 psi.
   Certified by: Oxarc Date: 8/22/97
4. # 250-1060 Concentration: 6.0 % O_2 Cyl. Press.: 1350 psi.
   Certified by: Oxarc Date: 8/22/97

Analyzer: Calibrated Range: 0-25.0 % Output: 0-100 mv.

Flow: 1500 cc/min Measured by: Rotameter: X Mass Flowmeter: ____

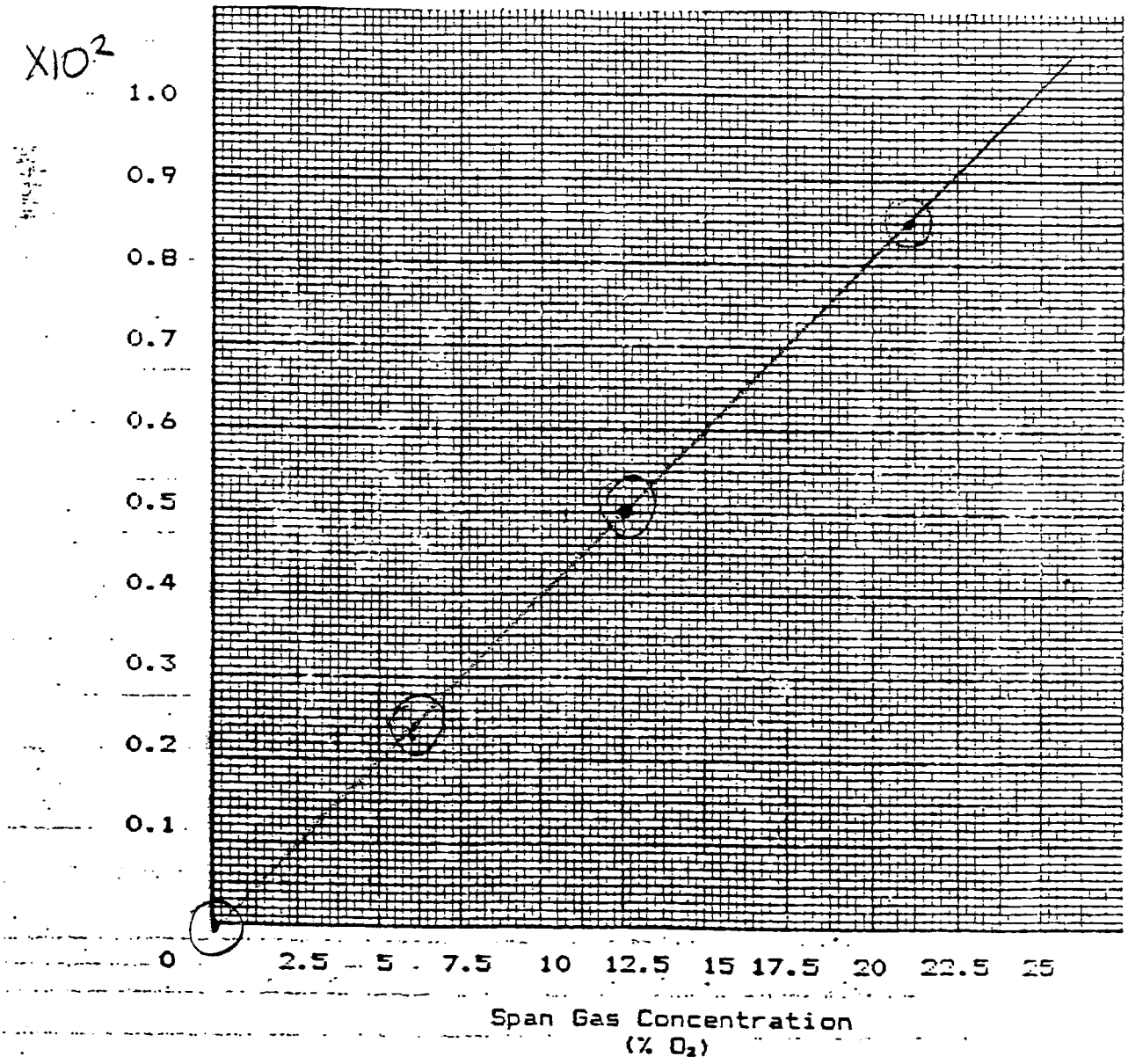
Calibration Results

Point #	Cyl. #	% O_2	Expected Meter	Expected DVM	Actual Meter	Actual DVM	Adj. Meter	Adj. DVM	% Dif.	Potentiometer Unadj.	Potentiometer Adj.	
1	1	00.0	00.0	00.0	00.0	00.0	—	—	—	—	—	
2	2	12.5	12.5	50.0	12.8	50.8	12.75	50.0	—	—	—	
3	3	21.0	21.0	84.0	21.0	84.1	—	—	+0.03	—	—	21.006
4	4	6.0	6.0	24.0	6.0	24.0	—	—	-0.03	—	—	5.998
5	1	00.0	00.0	00.0	00.0	00.0	—	—	—	—	—	

Comments: 50.0 = 12.490759 4

Linear Regression Results:

Y = MX + B
Slope (M) = .997143
Y Intercept (B) = .005044
Correlation Coefficient (r) = 0.999147



Comments

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Pre Kuma Wood Classic

QA WS 1/85

CO ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Site: Colville, WA Date: 9/10/99

Analyzer: Make: Infra Red Model: 702 0 SN: 113

Calibration by: A.T. Myren

Cal Gas Flow: 1.5 SCFH Measured by: Rotameter: ✓ Mass Flowmeter: ____
BP: 29.78 "Hg Instrument ID: Weems
Temp: 80°F Instrument ID: Jenco

Analyzer last calibrated: 7/30/99 By: A.T. Myren

Cylinders:

1. # 719430 Concentration: 00.0 % CO Cyl. Press.: 1860 psi.
   Certified by: Oxarc Date: 4/1/99
2. # 250-794 Concentration: 2.50 % CO Cyl. Press.: 1330 psi.
   Certified by: Oxarc Date: 3/26/99
3. # 250-1175 Concentration: 4.03 % CO Cyl. Press.: 1380 psi.
   Certified by: Oxarc Date: 9/22/97
4. # 250-1060 Concentration: 1.26 % CO Cyl. Press.: 1350 psi.
   Certified by: Oxarc Date: 9/22/97

Analyzer: Calibrated Range: 0-5.0 % Output: 0-100 mv.

Flow: 1.5 SCFH Measured by: Rotameter: ✓ Mass Flowmeter: ____

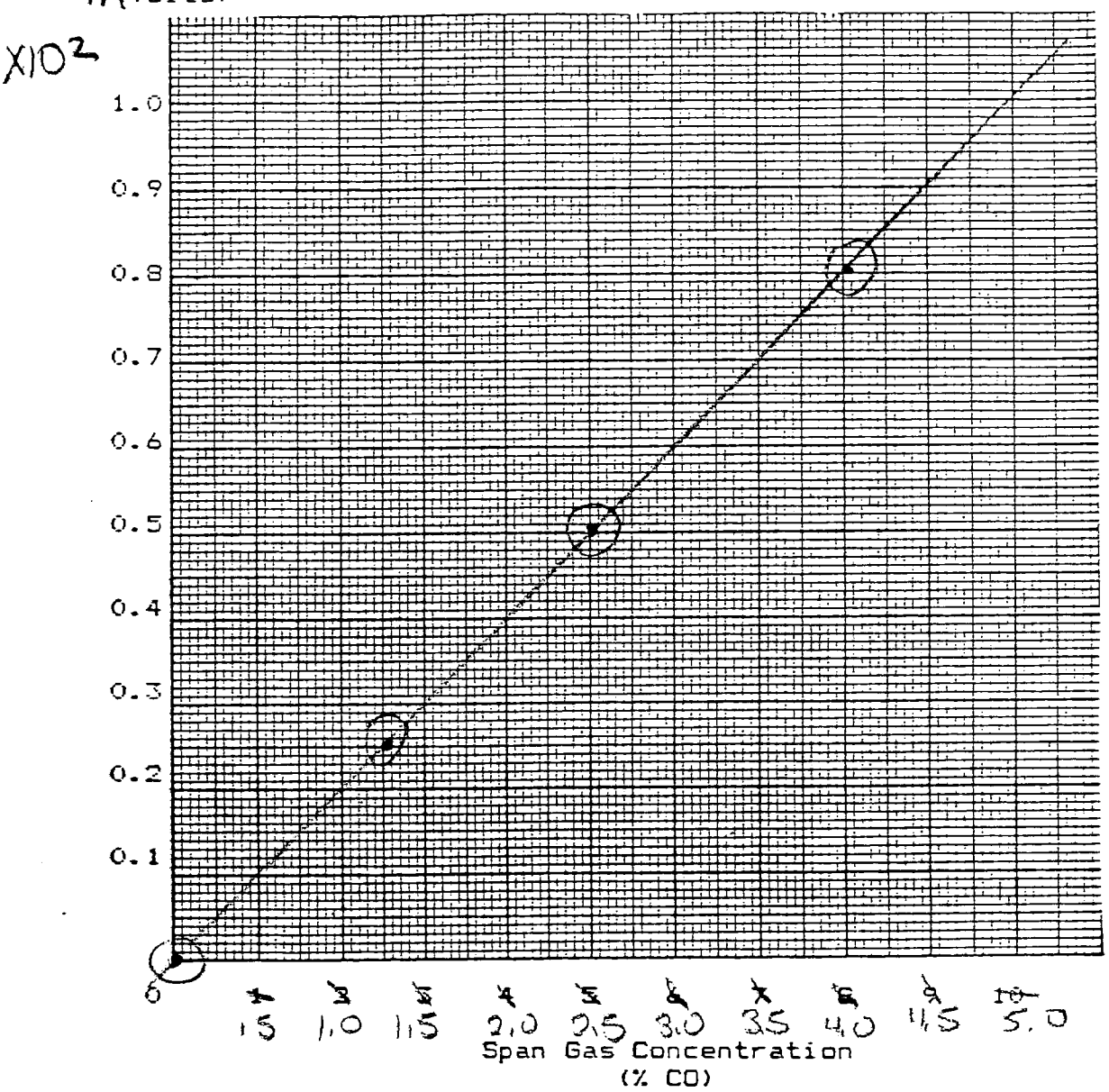
Calibration Results

Point #	Cyl. #	% CO	Expected Meter	Expected DVM	Actual Meter	Actual DVM	Adj. Meter	Adj. DVM	% Dif.	Potentiometer Unadj.	Potentiometer Adj.
1	1	00.0	0.00	00.0	0.00	00.0	—	—	—	—	—
2	2	2.50	2.50	50.0	2.56	51.5	2.50	49.9	—	—	—
3	3	4.03	4.03	80.6	4.03	80.8	—	—			
4	4	1.26	1.26	25.2	1.30	25.8	—	—			
5	1	00.0	0.00	00.0	0.00	00.0	—	—			

Comments: 50.0 = 2.4914065

Linear Regression Results:

Y = MX + B
Slope (M) = 19.994246 4
Y Intercept (B) = 0.1862051
Correlation Coefficient (r) = 0.99 14597



Comments

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FAX (509) 662-1229

YAKIMA, WA 98903
1004 EAST MEAD
(509) 248-0827
FAX (509) 452-8704

Primary Standard Certificate of Analysis
Method of Analysis Micro GC / Gravimetric
Customer: Myren Consulting **Reference # PM7234-4**
P.O.# **Cylinder # 250-1060**

Results of Investigation

Component	Requested	Concentration
Air	N/A	N/A
Argon	N/A	N/A
Carbon Dioxide	6.00%	6.00%
Carbon Monoxide	1.25%	1.26%
Helium	N/A	N/A
Hydrogen	N/A	N/A
Methane	N/A	N/A
Nitrogen	Balance	Balance
Oxygen	6.00%	6.00%

Hazard Class	UN 1956
DOT Shipping Name	Compressed Gas NOS
Shipping Volume (scf approximate)	160 scf @ ntp
Cylinder Pressure	1500 psig
CGA Valve Connection	350

Oxarc Primary Standard mixtures are prepared with gravimetric techniques using weights traceable to NIST. Mixture blended to +/- 1% relative to minor component and certified to +/- 1% analytical accuracy.

Authorized Signature Travis Auger Date 8/25/97

Travis Auger

Comments:

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McNARY HIWAY
(503) 567-7377
FAX (503) 567-2265

KENNEWICK, WA 99336
800 W. COLUMBIA DR.
(509) 582-4202
FAX (509) 586-9859

LEWISTON, ID 83501
2513 3RD. AVE., NORTH
(208) 743-6571
FAX (208) 746-8374

MOSES LAKE, WA 98837
1401 WHEELER ROAD
(509) 765-9247
FAX (509) 766-9958

OKANOGAN, WA 98840
2256 ELMWAY
(509) 826-3205
FAX (509) 826-3905

PASCO, WA 99302
716 SOUTH OREGON
(509) 547-2494
FAX (509) 547-3103

TWIN FALLS, ID 83303
729 COMMERCIAL AVE.
(208) 734-9711
FAX (208) 734-7923

WENATCHEE, WA 98801
OHME GARDENS RD.
(509) 662-8417
FAX (509) 662-1229

YAKIMA, WA 98903
1004 EAST MEAD
(509) 248-0827
FAX (509) 452-8704

Primary Standard Certificate of Analysis
Method of Analysis Micro GC / Gravimetric
Customer: Myren Consulting **Reference # PM7234-2**
P.O.# **Cylinder # 250-1175**

Results of Investigation

Component	Requested	Concentration
Air	N/A	N/A
Argon	N/A	N/A
Carbon Dioxide	21.0%	21.0%
Carbon Monoxide	4.00%	4.03%
Helium	N/A	N/A
Hydrogen	N/A	N/A
Methane	N/A	N/A
Nitrogen	Balance	Balance
Oxygen	21.0%	21.0%

Hazard Class	UN 1956
DOT Shipping Name	Compressed Gas NOS
Shipping Volume (scf approximate)	160 scf @ ntp
Cylinder Pressure	1500 psig
CGA Valve Connection	350

Oxarc Primary Standard mixtures are prepared with gravimetric techniques using weights traceable to NIST. Mixture blended to +/- 1% relative to minor component and certified to +/- 1% analytical accuracy.

Authorized Signature _____ Date 8/25/97
Travis Auger

Comments:

Welding Products • Industrial Supplies
Industrial Gases • Medical Gases
Specialty Gases • Beverage Systems
Safety Products • Fire Equipment

Main Office
Spokane, WA 99202
4303 E. Broadway
P.O. Box 2925
PH. (509) 535-7734
FAX (509) 535-0368

Boise, ID 83709
7615 W. Lemp St.
PH. (208) 376-0377
FAX (208) 376-1133

Coeur d'Alene, ID 83814
3530 Ramsey Rd.
PH. (208) 765-3311
FAX (208) 667-5974

Colville, WA 99114
328 W. 1st
PH. (509) 684-3776
FAX (509) 684-6742

Ellensburg, WA 98926
704 N. Wenas
PH. (509) 925-1518
FAX (509) 925-1136

Hermiston, OR 97838
Hermiston-McNary Highway
PH. (503) 567-7377
FAX (503) 567-2265

Lewiston, ID 83501
2513 3rd Ave., North
PH. (208) 743-6571
FAX (208) 746-8374

Moses Lake, WA 98837
1401 Wheeler Road
PH. (509) 765-9247
FAX (509) 766-9958

Okanogan, WA 98840
2256 Elmway
PH. (509) 826-3205
FAX (509) 826-3905

Pasco, WA 99302
716 South Oregon
PH. (509) 547-2494
FAX (509) 547-3103

Twin Falls, ID 83303
729 Commercial Ave.
PH. (208) 734-9711
FAX (208) 734-7923

Wenatchee, WA 98801
291 Ohme Gardens Rd.
PH. (509) 662-3417
FAX (509) 662-1239

[illegible]
[illegible] E. [illegible]
PH. (509) [illegible]-327
FAX (509) 452-3704

www.oxarc.com

Primary Standard Certificate of Analysis
Cylinder filled in Pasco WA
Method of Analysis Micro GC / Gravimetric
Customer: Myren Consulting **Reference # PA90844**
P.O.# **Cylinder # 250-794**

Results of Investigation

Component	Requested	Concentration
Air	N/A	N/A
Argon	N/A	N/A
Carbon Dioxide	12.5 %	12.5 %
Carbon Monoxide	2.50 %	2.50 %
Helium	N/A	N/A
Hydrogen	N/A	N/A
Methane	N/A	N/A
Nitrogen	Balance	Balance
Oxygen	12.5 %	12.5 %

Hazard Class	**UN 1956**
DOT Shipping Name	**Compressed Gas NOS**
Shipping Volume (scf approximate)	**180 scf @ ntp**
Cylinder Pressure	**1600 psig**
CGA Valve Connection	**350**

Oxarc Primary Standard mixtures are prepared with gravimetric techniques using weights traceable to NIST. Mixture blended to +/- 2% relative to minor component and certified to +/- 1% analytical accuracy.

Authorized Signature _____ **Date** 3/20/09
Travis Auger

Comments:

MALLINCKRODT

CERTIFICATE OF ANALYSIS

A Division of Mallinckrodt Baker, Inc.
222 Red School Lane • Phillipsburg, NJ 08865
Telephone: (908) 859-2151 • Fax: (908) 859-9318

ITEM: ACETONE AR (ACS)
CODE: 2440
LOT : KTDC

TESTS	LIMITS	RESULTS
TITRATABLE ACID	0.0003 meq/g Max.	0.0002 meq/g
ALDEHYDE	0.002% Max.	0.002%
TITRATABLE BASE	0.0006 meq/g Max.	0.0004 meq/g
ISOPROPYL ALCOHOL	0.05% Max.	0.005%
METHANOL	0.05% Max.	0.005%
RESIDUE AFTER EVAPORATION	0.001% Max.	0.0002%
SOLUBILITY IN WATER	To Pass Test	Passes Test
SUBSTANCES REDUCING PERMANGANATE	To Pass Test	Passes Test
WATER	0.5% Max.	0.3%
COLOR	APHA 10 Max.	APHA 5
ASSAY	99.5% Min.	99.9%

It is hereby certified that the above is a true copy of the actual analysis of the lot indicated.

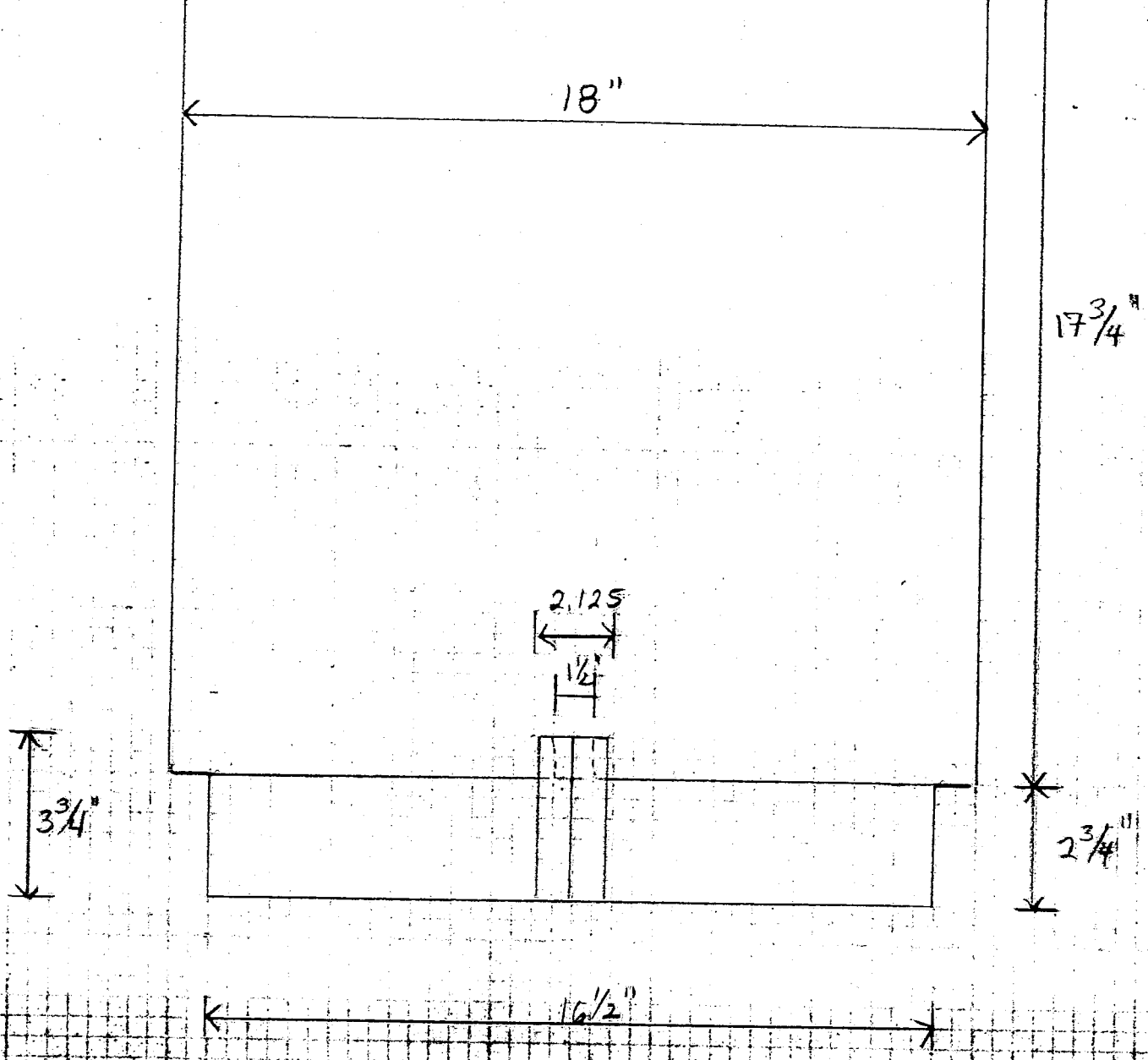
Mark Featherston

Mark Featherston
Manager, QA/QC
Mallinckrodt Baker, Inc
03/07/96 wwr

2 Bottles. Same Lot #
Acetone Purchased 7/10/96
1st blank done 8/8/96
2nd blank done 9/10/97
3rd blank done 8/10/97
4th Blank done 3/13/97
5th blank done 3/10/98
6th blank done 3/5/99
7th blank done 7/18/99

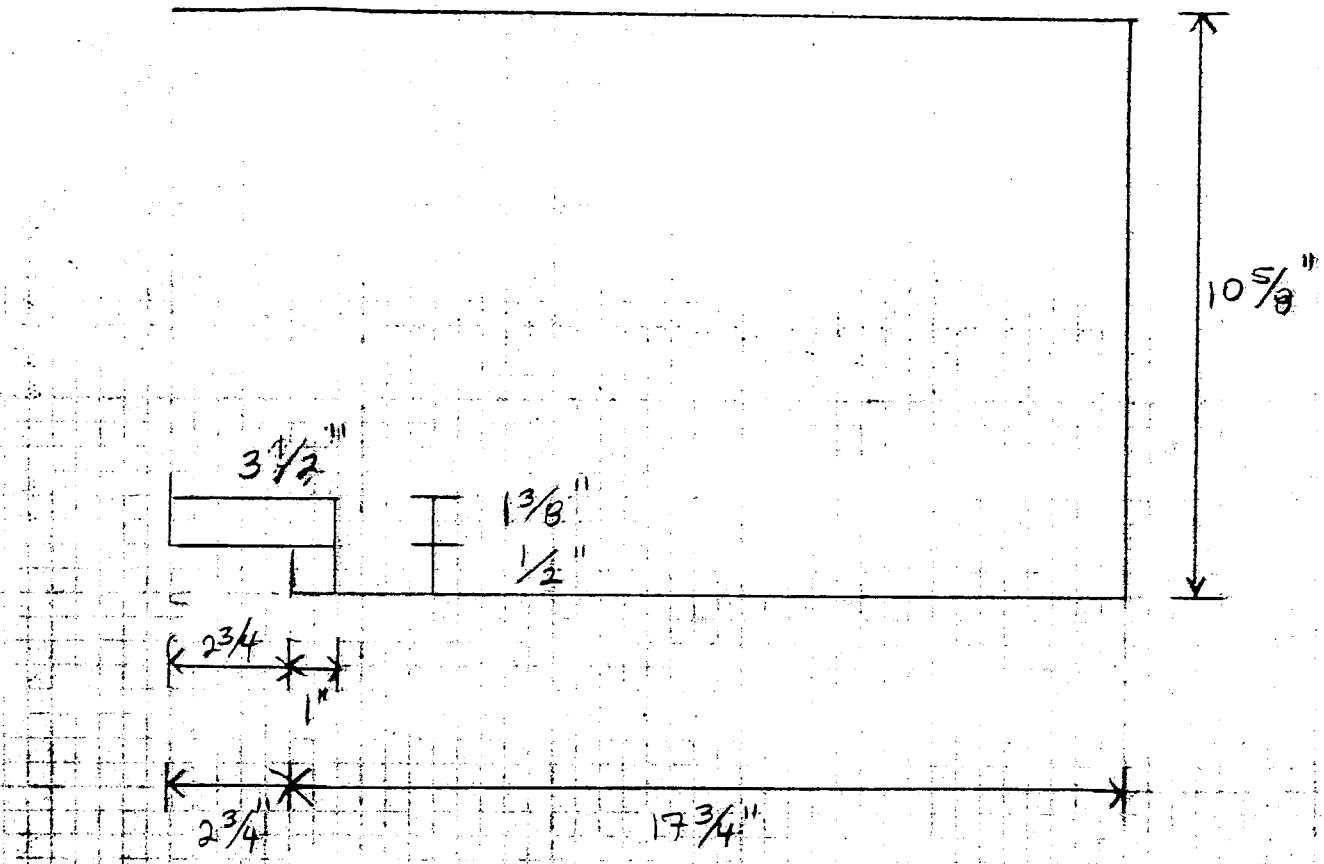
Stove QC

The Kuma Wood Classic noncatalytic wood stove is a large mid sized stove. It has a useable firebox volume of 2.3 cubic feet. Its most distinguishing feature is the fact that it is a step top design. It has a rear secondary air preheat chamber and uses four SS tubes to deliver the secondary air to the combustion chamber. The unit also has a LPAO that takes its air directly from the air in the pedestal, rather than from the primary air duct behind the door.



Top View

Kuma Wood Classic
Top View Not to Scale
A.T. Myren



Side View

Kumz Wood Classic
Side View - Not to Scale
Artmyren

Useable Firebox Volume Calculations:

18 x 17.75 x 10.625 =	3394.688 ✓
16.5x 2.75 x 10.625 =	482.109 ✓
	3876.797 ✓

Less:

Primary Air Duct behind door

2.75 x .5 x 16.5 = 22.688

LPAO

$\frac{1.5 \times 1.5}{2} \times 3.5 = 3.938$

1.5 x 1 x .5 = 0.75

27.376

3876.797 − 27.376 = 3849.421 $in^3 \div 1728\ in^3/ft^3 =$ 2.228 ft^3

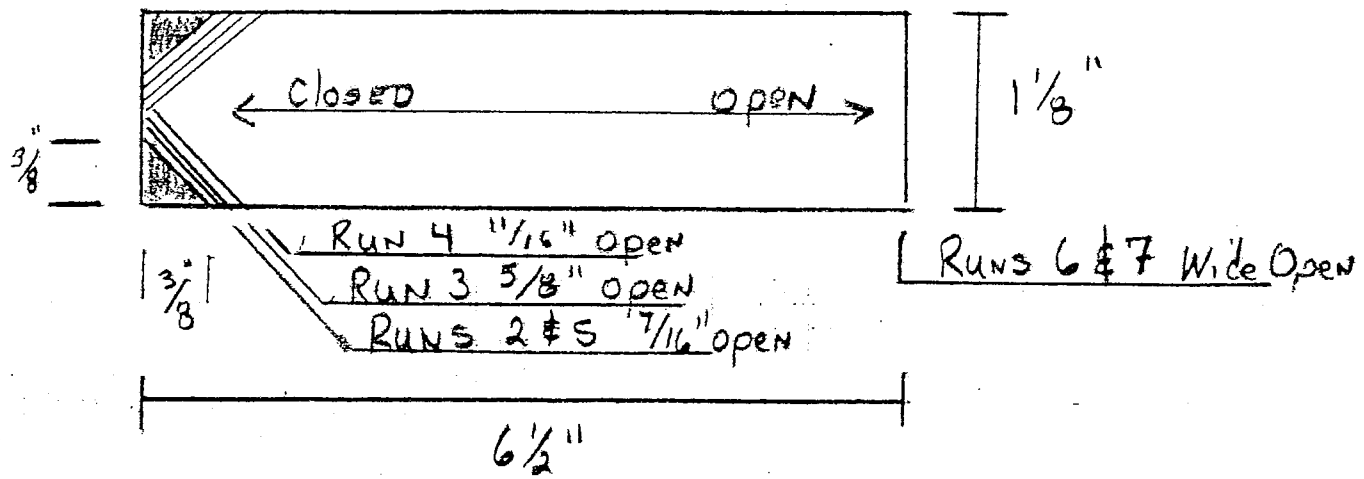
Fuel Load Calculations:

2.228 ft^3 x 7 lbs / ft^3 = 15.594 lbs. Ideal Fuel Load Wt.

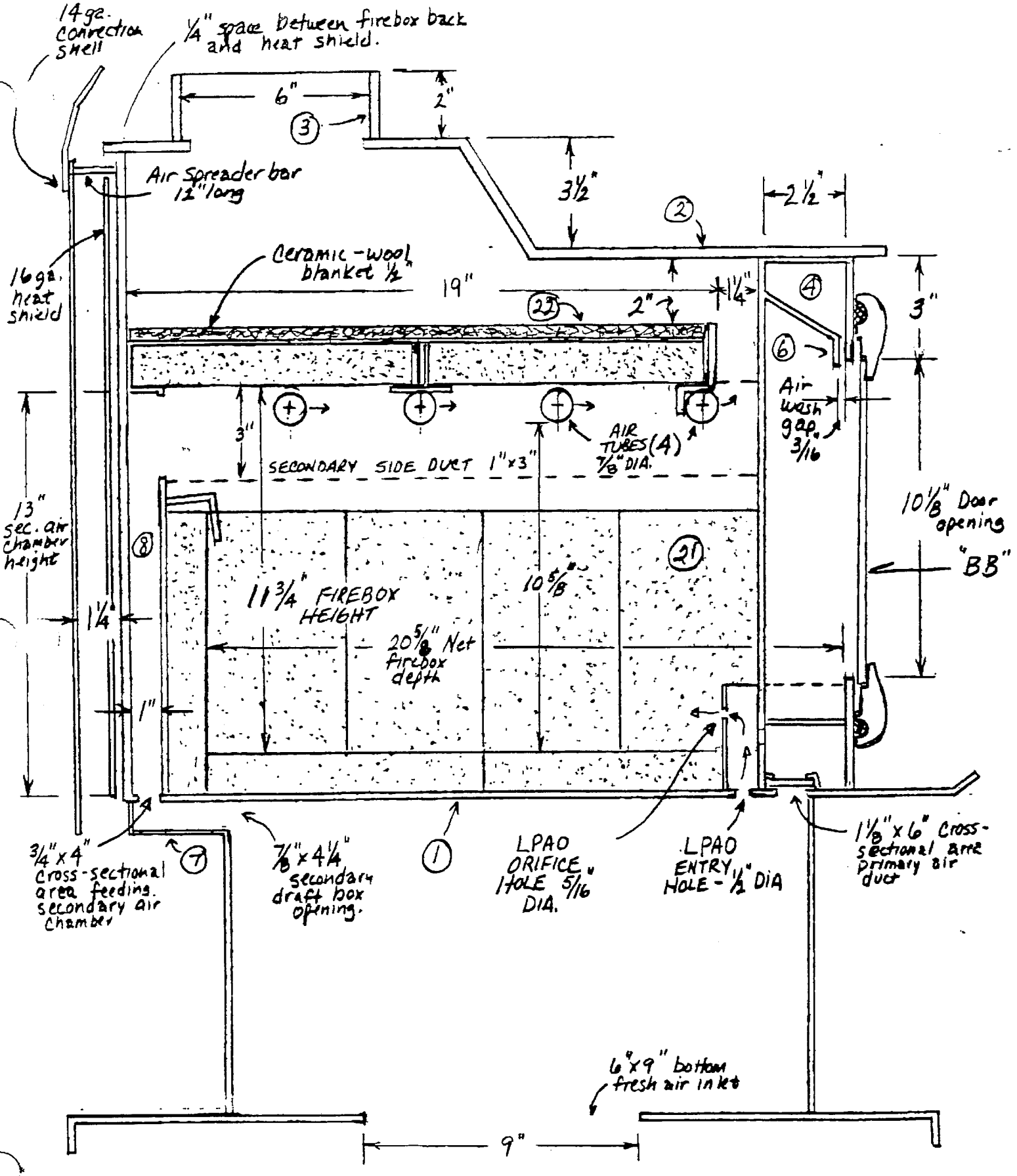
15.594 ± (.10 x 15.594) = 17.153 − 14.034 lbs

= 17.1 − 14.1 lbs Fuel Load Weight Range

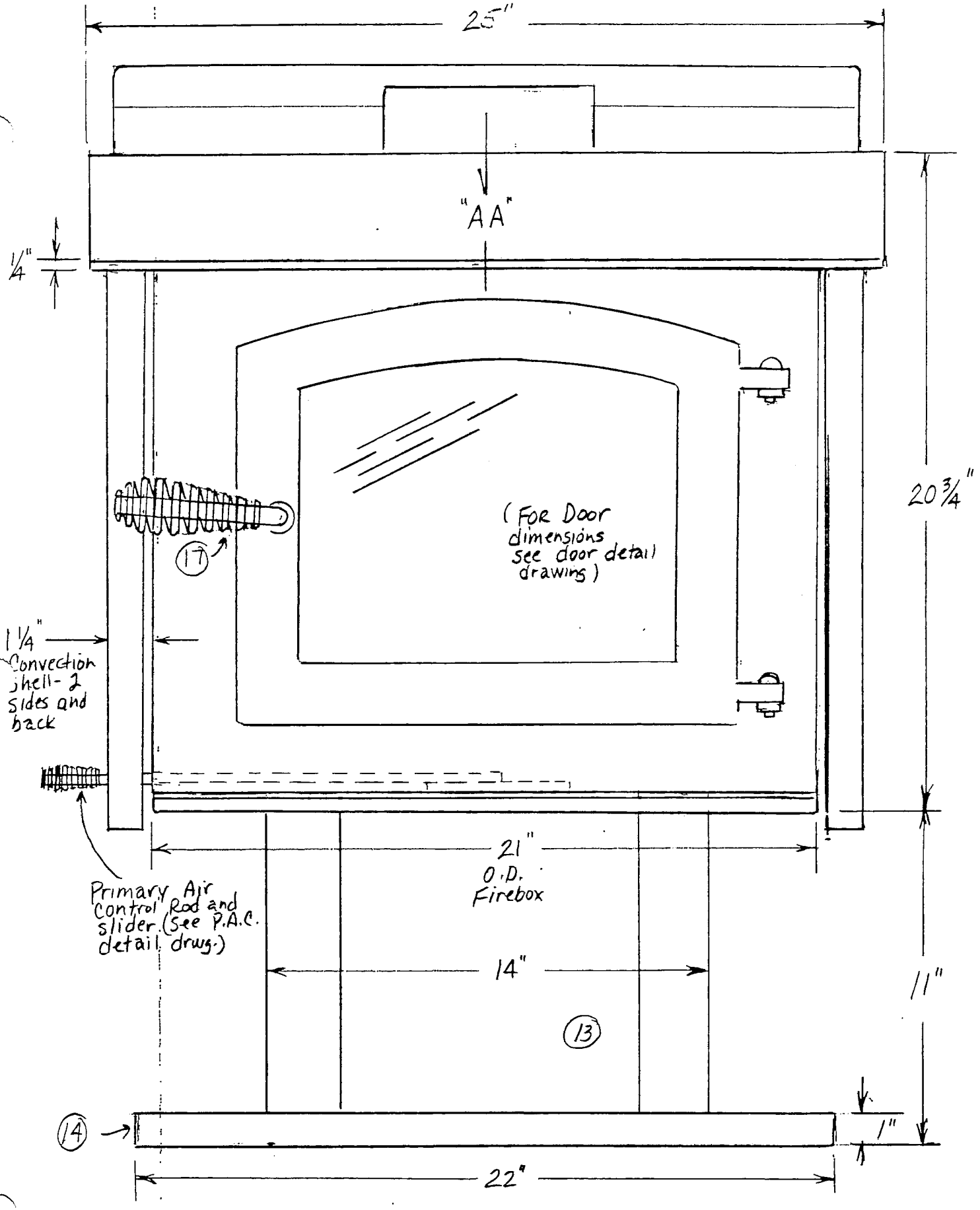
Primary Air Inlet Dimensions:



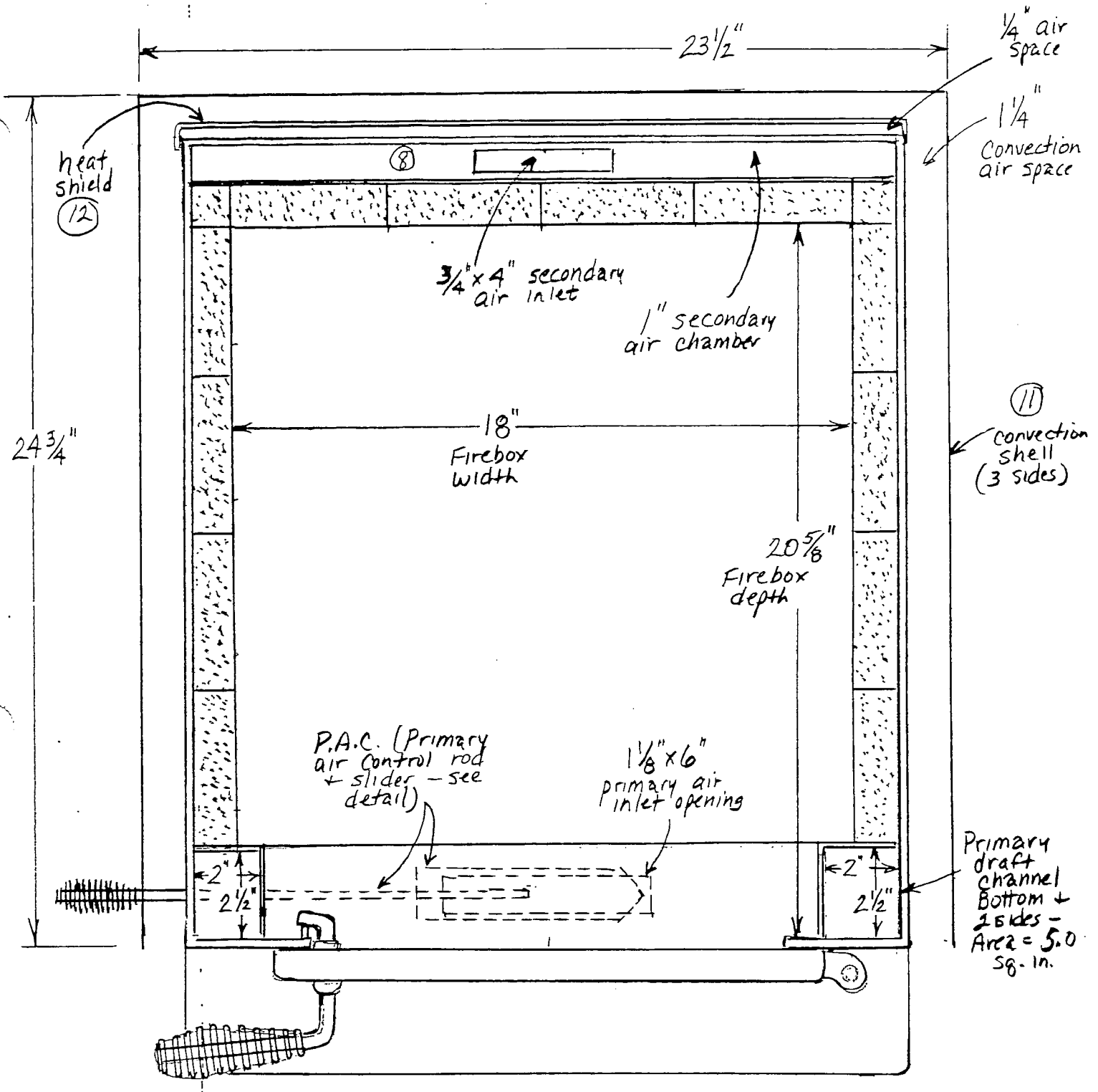
Shaded area = amount the PAC was open for the Low burn. Run 1



TITLE: KUMA WOOD CLASSIC	DR. NO. 1	DR. BY M.F.
VIEW: SIDE; CROSS-SECT. A-A.	DATE 9/14/99	SCALE 1/4" = 1



TITLE: KUMA WOOD CLASSIC	DR. NO. 2	DR. BY: M.F.
VIEW: FRONT	DATE: 9/14/99	SCALE: 1/4" = 1'



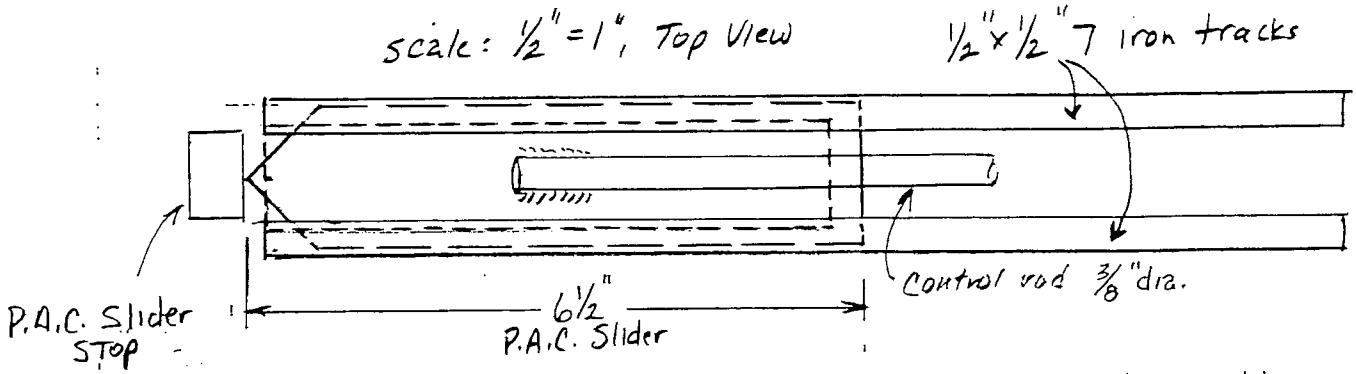
TITLE: KUMA WOOD CLASSIC	DR. NO. 3	DR. BY: M.F.
VIEW: TOP CROSS-SECT. "B-B"	DATE: 9/14/99	SCALE: ¼" = 1"

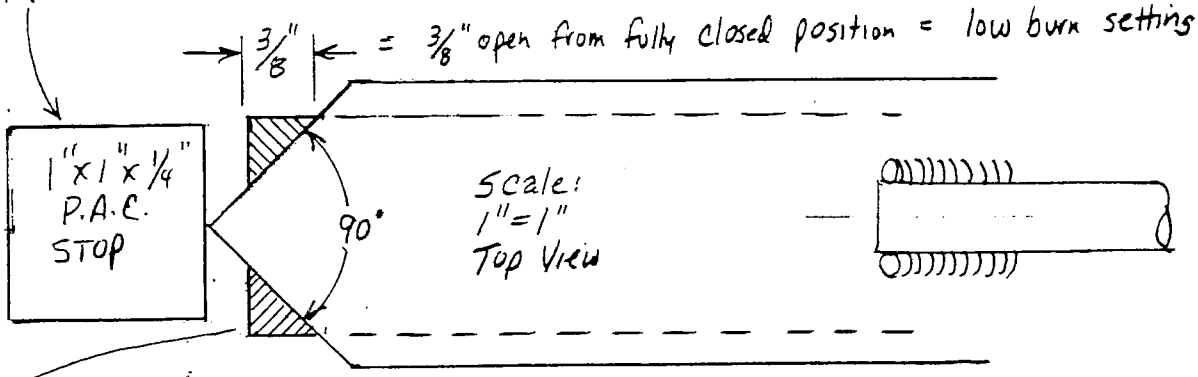
(5)

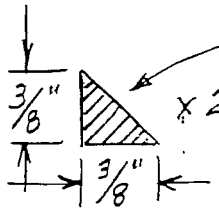
----- = 1⅛" x 6" primary air opening

— — = ¼" x 1½" P.A.C. Slider

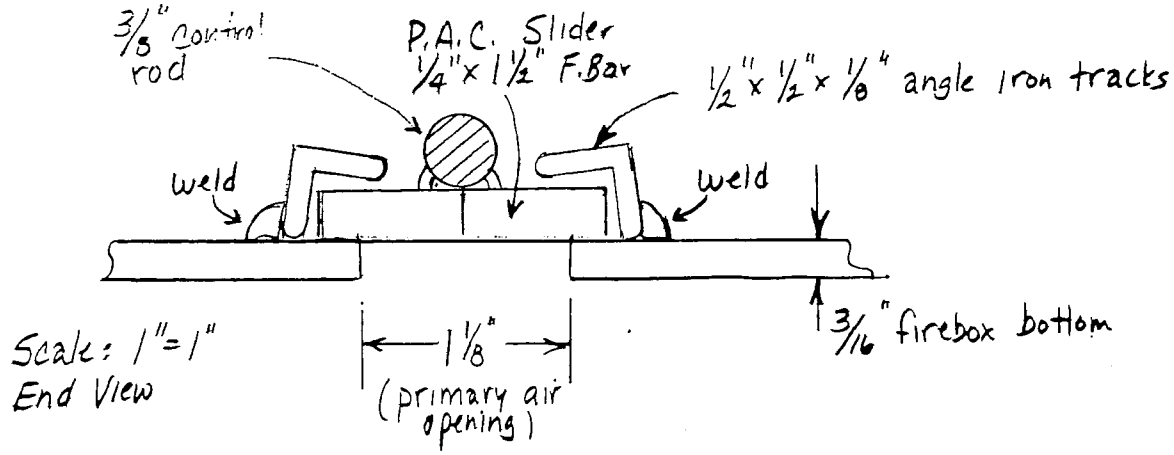
scale: ½" = 1", Top View



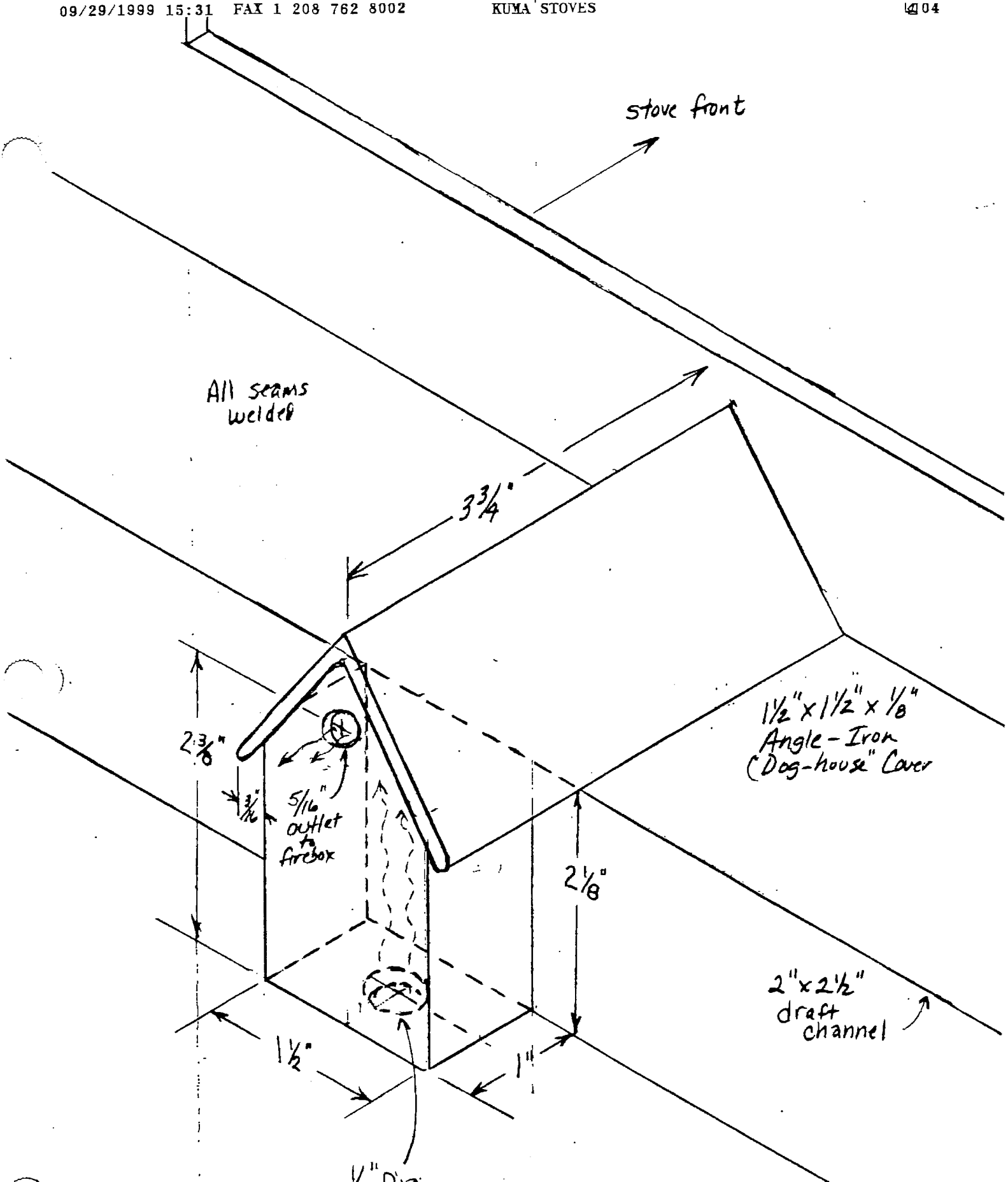




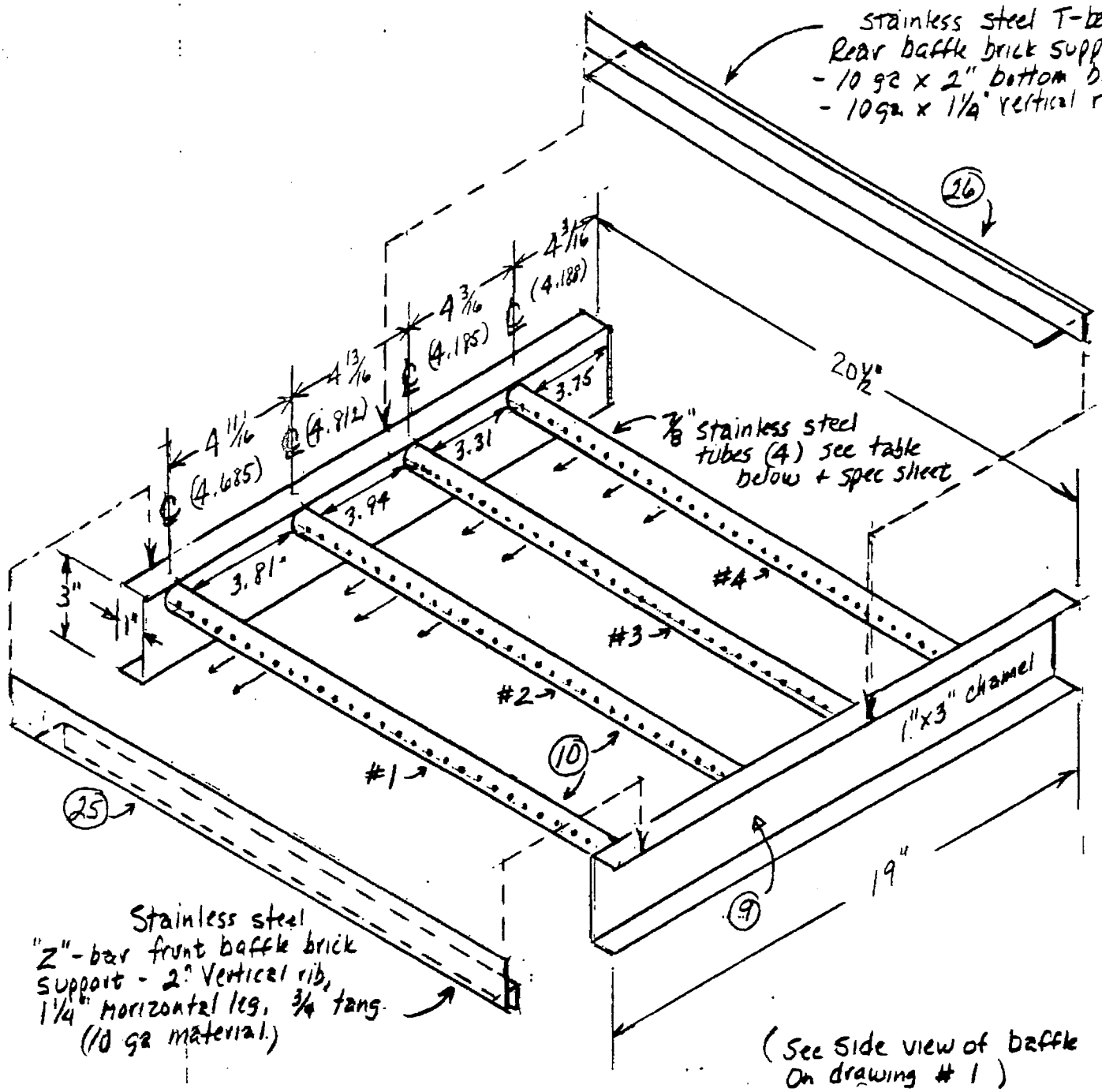
x 2 = open area at low burn setting — .375 x .375 = .1406 sq. in



TITLE: KUMA WOOD CLASSIC	DR. NO. 4	DR. BY: M.F.
VIEW: PRIMARY AIR CONTROL DETAIL	DATE: 9/14/99	SCALE: AS NOTE



TITLE: KUMA WOOD CLASSIC	DR. NO. 5	DR. BY: M.F.
VIEW: L.P.A.O DETAIL	DATE: 9/14/99	SCALE: 1" = 1"

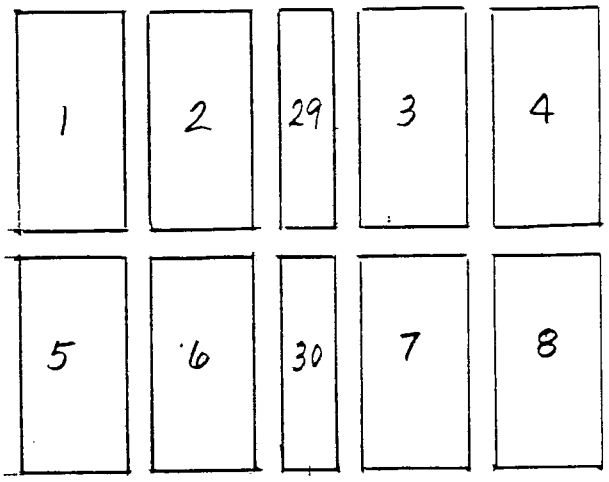


Tube #	No. of Holes	Hole Spacing	Hole Dia.
1	37	½" ℄	5/32"
2	59	[illegible]" ℄ 5/16"	⅛"
3	37	½" ℄	⅛"
4	19	1" ℄	⅛"

TITLE: KUMA WOOD CLASSIC	DR. NO. 6	DR. BY: M.F.
VIEW: BAFFLE DETAIL PERSPECTIVE	DATE: 9/14/99	SCALE: 3/16"=1"

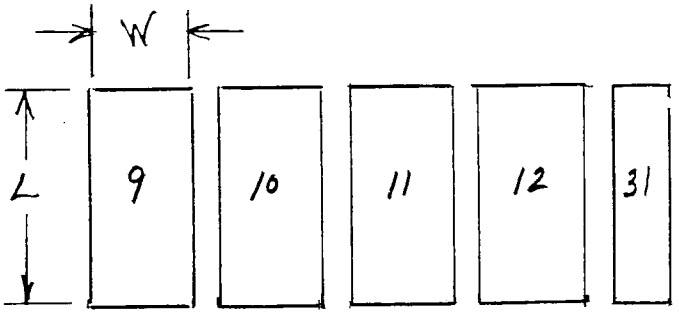
All Refractory is Low-Duty firebrick Mfg. by: Mutual Materials Co., Inc., Bellevue, Wa.

Composition:
81% Fireclay
19% Silicated Alumina

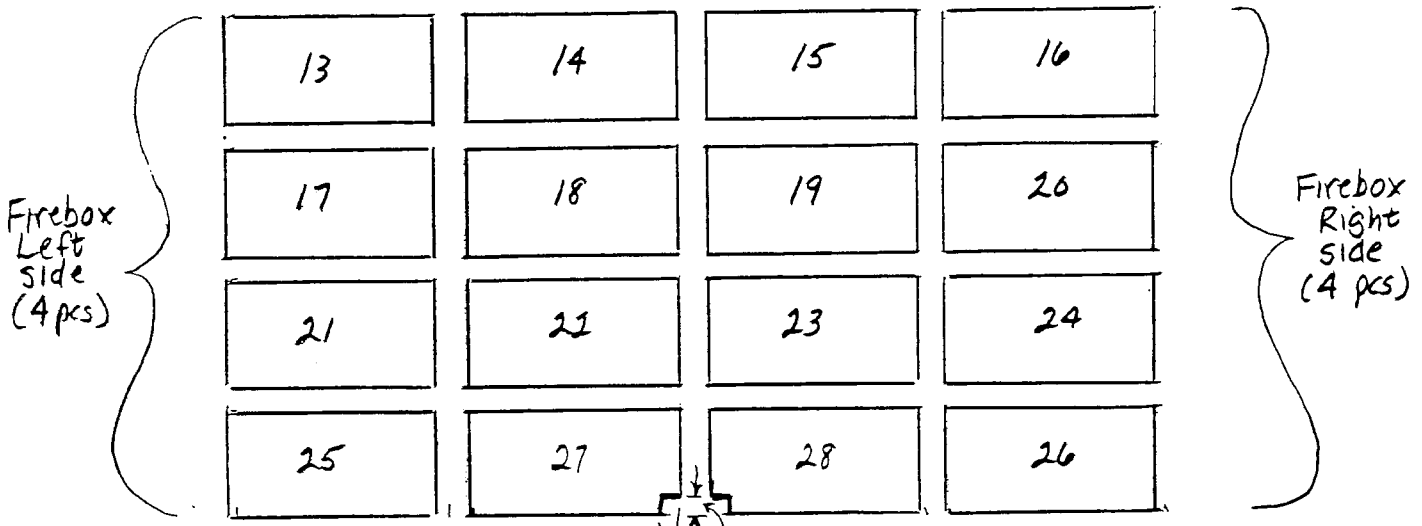


Top View of Baffle Fire brick Layout (10 pcs)

(21)



Firebox Back (5 pcs)



Firebox Left Side (4 pcs)

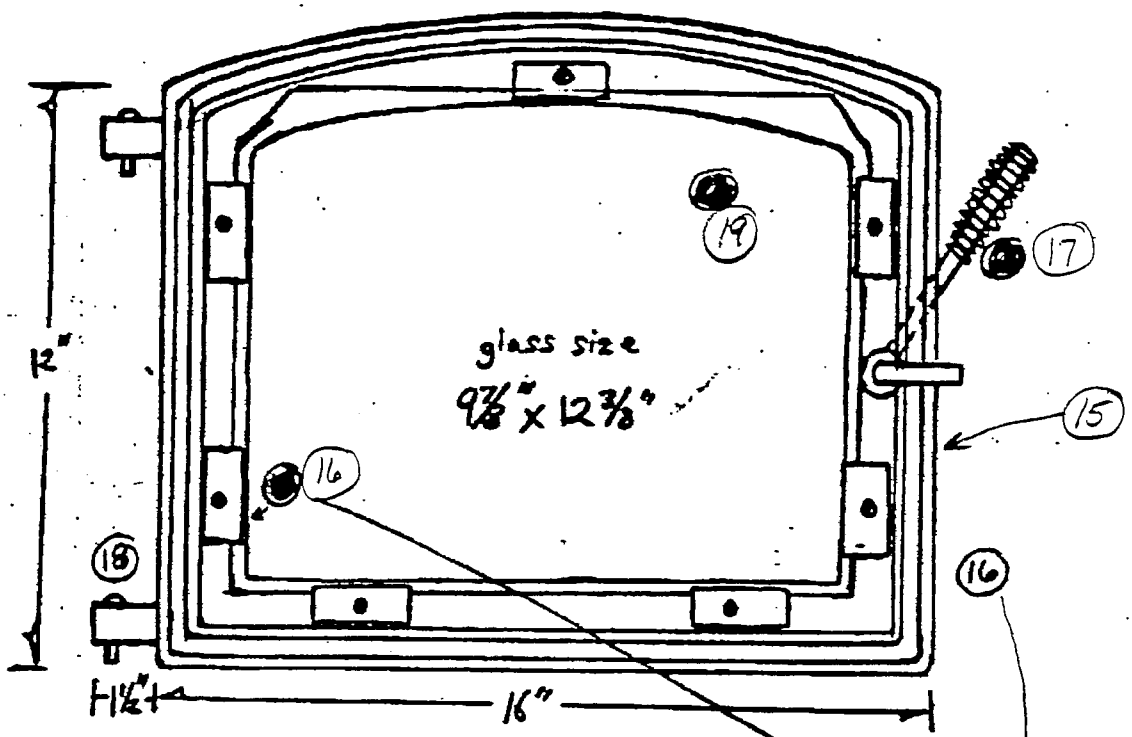
Firebox Right side (4 pcs)

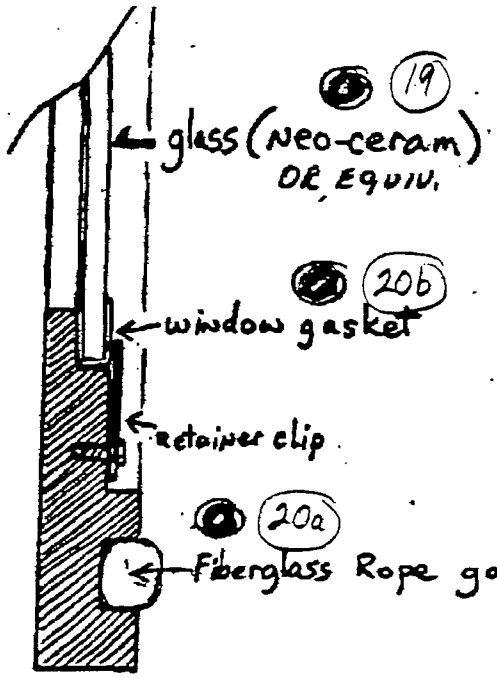
Firebox Bottom (8 pcs)

Dimensions	L	W	Thick.
No. 1 - 26	9"	4½"	1¼"
No. 27-28 *	9"	4½"	1¼"
No. 29-31	9"	2¼"	1¼"

* No 27, 28 have a ¾" x 1" Notch to accomodate the L.P.A.O. tower.

TITLE: KUMA WOOD CLASSIC	DR. NO. 7	DR. BY: M.F.
VIEW: FIREBRICK DETAIL	DATE: 9/14/99	SCALE: 1/8" = 1"





16

NOTE: Glass retainer is a one-piece, full perimeter ring to secure glass. It is 10 ga. steel x 1" in width - 7 Fasteners.

cutaway side view
(not to scale)

TITLE: KUMA WOOD CLASSIC	DRAW. NO. 8	DR BY. S.C.
VIEW: DOOR DETAIL	DATE: 9-14-99	SCALE 1/4"=1"

	DESCRIPTION	DIMENSIONS	QTY.	MATERIAL, MFG., MODEL, ETC.
1.	Firebox Assembly	23⅞ × 21" × 20⅜"	1	A-36 Steel 3/16" plate
2.	Firebox Top	25" × 26"	1	A-36 Steel ¼" Plate
3.	Flue Collar	2"H × 6" I.D.	1	Mild Steel 3/16" Thick
4.	Primary Draft Channel	2" × 2½"	1	Mild Steel 10 ga.
5.	Primary Air Control	⅜" × 16"	1	⅜" Dia. C.R. Steel
6.	Primary Air Wash	3 5/8" × 16¼"	1	Mild Steel 10 ga
7.	Secondary Draft Box	3" × 4⅜ × 1"	1	Mild Steel 12 ga.
8.	Secondary Draft Channel	12¾" × 20½"	1	Mild Steel 10 ga.
9.	Secondary Draft Manifolds	1" × 3" × 19"	2	Mild Steel 12 ga.
10.	Secondary Draft Tubes	⅞" dia. × 18"	4	Stainless Steel .049 wall
11.	Convection Shell	24¾" × 23½" × 21⅜"	1	Mild Steel 14 ga.
12.	Heat Shield	21" × 20⅜"	1	Mild Steel 16 ga.
13.	Pedestal	14" × 19"	1	Mild Steel 10 ga.
14.	Pedestal Base	22" × 28"	1	Mild Steel 10 ga
15.	Door	1¼" × 13" × 16"	1	Cast Iron
16.	Glass Retainer	11 5/8 × 14"	1	Mild Steel 10 ga. × 1" wide
17.	Door Handle	½" × 7"	1	½" H.R. Round
18.	Door Pins	⅜" × 2"	2	Steel, Rd Hd. Rivet
19.	Glass	10" × 12 ⅜"	1	5mm Neo-Ceramic
20.	Door Gasket	⅝" × 54"	1	Woven Fiberglass rope product; 96.5 fibrous glass, 3.5% surface sizing. Mfg. by Heatsafe, Inc. Redmond, Wa
20.	Glass Gasket	⅛" × ¾" × 45"	1	
21.	Firebrick	4½" × 9"	28	81% Firecley, 19% Silica Alumin Mfg. by Mutual Materials Co. Inc Bellevue, Wa.
		2¼" × 9	3	
22.	Baffle Wool Blanket	19" × 20"	1	½" Thickness Ceramic Wool Fiber Blanket, 4 lb. density / ft., Mfg. by Western Industrial Ceramics.
23.	Blower Motor (not shown)	4" × 4½" × 14"	1	Model A-125 Mfg. by Fasco Industri 115V, 3200 RPM, 125 cfm.
24.	Blower Speed Control	2½" × 3½" × 1½	1	Wells Tech. Prod. ILS-3-ST 3 Amps
25.	Baffle Brick Support (F)	2" × 1½" × 20½	1	Stainless Steel F.B.
26.	Baffle Brick Support (R)	2" × 1¼" × 20½	1	Stainless Steel F.B.
27	L.P.A.O. Tower	1" × 2" × 3½"	1	Mild Steel

TITLE:	DR. NO.	DR. BY:
KUMA WOOD CLASSIC	9	M.F.
VIEW:	DATE:	SCALE:
SPECIFICATION LIST	9/14/99	—

OPERATING INSTRUCTIONS

FOR THE

KUMA WOOD CLASSIC

DURING

EPA CERTIFICATION TESTING

PRIMARY AIR CONTROL (PAC):

Slide rod in to reduce the amount of air entering the stove. To set the control, measure the gap between the end of the spring closest to the stove and the side heat shield. At the "Stop" the gap should be ¾" and the PAC should be open 3/8".

	Gap	PAC Open
Low: Set control at the stop	0.75"	0.375"
Medium Low: Set control at	0.75- 1.125"	0.375- 0.75"
Medium High: Set control at	0.875- 1.50"	0.5- 0.75"
High:	Wide Open	Wide Open
Fan Confirmation Test:	0.75-0.875"	0.375-0.5"

DOOR:

Normally close the door as soon as the test fuel has been loaded in the stove. If the fire is slow to start, crack the door open until the fuel ignites, then close the door.

FAN:

Operate the fan as follows:
Low, Medium Low and Medium High: Turn fan on high at 30 minutes.
High: Turn fan on as soon as the fuel is loaded (~1 minute).

Lower Primary Air Orifice (LPAO):

Clear the coals away from in front of the LPAO on all runs.

Mark Freeman
9/7/99

Revised
9/21/99

Kuma Stove and Iron Works

Rathdrum, ID. 83858

MODEL:

WOOD CLASSIC

INSTALLATION AND OPERATING INSTRUCTIONS

SAVE THESE INSTRUCTIONS

This manual describes the installation and operation of the KUMA model *Wood Classic* wood heater. Under specific test conditions, this heater has been shown to meet the U.S. Environmental Protection Agency's emission limits for residential wood heaters.

Please read the following safety precautions and the entire installation and operating instructions.

SAFETY PRECAUTIONS

1. If this stove is not properly installed, a house fire can occur. For your protection, follow the installation instructions provided. We recommend contacting local building or fire officials regarding restrictions and installation inspection requirements in your area.
2. **DO NOT CONNECT THIS UNIT TO A CHIMNEY FLUE SERVING ANOTHER APPLIANCE.**
3. Do not use gasoline, gasoline-type lantern fuel, kerosene, charcoal lighter fluid, or similar liquids to start or "freshen up" a fire in this heater. Keep all such liquids well away from the heater while it is in use.
4. Do not burn garbage.
5. Do not overfire. The stove is in an overfire position if any part of the stove glows. If this should happen, immediately close air damper.
6. **WARNING: DO NOT INSTALL IN A SLEEPING ROOM.**
7. Caution: The structural integrity of a mobile home floor, wall, and ceiling/roof must be maintained.
8. Do not use single-wall pipe for exterior chimney or mobile home applications.
9. When installing into an existing metal or masonry chimney, examine the chimney system carefully. If you have any questions, seek professional advice. **DO NOT CONNECT THIS UNIT TO A CHIMNEY FLUE SERVING ANOTHER APPLIANCE.**
10. Note all minimum clearances to combustibles. Installation must comply with minimum clearances as listed in this manual.
11. **INSTALL AND USE IN ACCORDANCE WITH THE MANUFACTURER'S INSTALLATION AND OPERATING INSTRUCTIONS ONLY.**
12. Safety Notice: If this heater is not properly installed, a house fire may result. For your safety, follow the installation directions.
13. Do not operate stove with firing door in an open position.
14. This room heater must be connected to a minimum 6" diameter listed chimney that complies with U.L. 103, HT-Type factory built chimney, or a code approved masonry chimney with a U.L. 1777 listed flue liner.
15. When connecting single-wall stove or double-wall listed chimney connector from the stove flue collar to the listed factory built chimney or masonry chimney, make sure all interconnecting joints of the flue pipe and the connection at the flue collar are secured with three (3) sheet metal screws.
16. When connecting this stove to a masonry chimney, make sure you observe all applicable clearances to combustible ceilings, walls, or other combustibles. A masonry chimney must be a 6" diameter minimum and constructed with a liner according to NFPA 211 code. If you are passing a chimney through a combustible wall to an outside chimney, use a U.L. 103, HT-Type approved insulated chimney section with a wall thimble, maintaining chimney to manufacturer's listed minimum clearance to combustibles. When attempting to connect this stove into a masonry chimney use these steps:
    a. Chip out hole through masonry into liner at least 6" in diameter.
    b. Install stainless steel single-wall liner all the way into the masonry liner (see figure 2A).
    c. Seal or mortar stainless liner in with a refractory high-test type cement.
    d. Connect stove pipe into masonry hole.
    e. When passing through a combustible wall into masonry chimney, cut hole in wall large enough for the wall thimble, and use a U.L. 103, HT-Type insulated chimney section that directly connects into masonry liner described above (refer to figure 2A).

CODES AND APPROVALS:

The Kuma model Wood Classic stove is tested to U.L. 1482 safety standard and is listed by Omni Test Laboratories, Inc. This unit is also approved for alcove installations. Maximum alcove depth: 48". Minimum clearance from stove top to ceiling: 52".

MOBILE HOME INSTALLATION INSTRUCTIONS

Model: Kuma Wood Classic

CAUTION: THE STRUCTURAL INTEGRITY OF A MOBILE HOME FLOOR, WALL, AND CEILING/ROOF MUST BE MAINTAINED.

CAUTION: DO NOT INSTALL IN A SLEEPING ROOM.

Before you start, ensure that there are no major obstructions (i.e. floor joists, ceiling joists, electrical wires, heat ducts, plumbing, etc.).

Clearance: backwall– 6", corners– 4", sidewall– 14" (using HT-Type listed chimney and double-wall connector). See figures 5 and 6. Consult your local building official and build your hearth pad to local building requirements.

Typical hearth pad (see example: typical hearth pad on page 3)– 18" to front of unit, 6" to sides.

Material required for installation: 5 or 6" outside air duct with screen, roof mate to seal roof flashing, assorted nails and screws, 8-gauge ground wire, 3/8 lag bolts to fasten stove to the floor (length will depend upon hearth thickness)

Tools required: saber saw, screwdrivers, measuring tape, pencil, plumb line, electric drill and assorted bits, tin shears, knife, pliers, hammer.

1. After locating possible obstructions (joists, pipes, etc.) and taking into account the necessary combustible clearances (fig.2), position the stove in the intended installation position. Use a plumb line to locate the position of the ceiling hole for the chimney. Size the chimney hole to the recommended manufacturer's clearances for your chimney. Mark the hole.
2. Mark a pencil outline around the base of the stove. Move the stove out of the way.
3. Mark with a pencil the holes to be drilled to fasten the stove to the floor, then mark with a pencil a 6" for the fresh air intake. This hole may be positioned anywhere under the stove.
4. If ceiling and floor are clear of all obstructions, cut out the holes (NOTE: Do not cut ceiling trusses).
5. In case of attic space use a plumb line to locate the hole in the roof. Cut out the opening, keeping in mind the chimney manufacturer's recommended clearances.
6. Install the outside air duct to the floor using screws or nails. Ensure that your air duct has a screen or mesh to keep out rodents, etc. Air ducts must be 5 or 6".
7. Install a hearth pad 18" in front of the unit, 6" to the back, 6" to the sides according to local building codes or manufacturer's specs (see applicable figures– corner or straight wall).
8. Position the stove on the hearth and lag bolt the stove to the floor. Ensure that your lag bolts fasten securely to the floor of the mobile home.
9. Ground your stove to the mobile home frame with a minimum 8-gauge wire. See figure 2B wiring diagram.
10. For a list of typical chimney pipe parts, see figure 2.
11. Check all chimney pipe for damage. Do not use any damaged pipe. Installation procedures may vary from manufacturer to manufacturer of listed chimney. Install the chimney up through the hole in the ceiling and roof, observing pipe manufacturer's minimum clearance to combustibles.
12. In cases where there is attic space, install a protective joist shield tube or box. Consult local building officials or chimney manufacturer.
13. Install the roof flashing, sealing water tight. Install the storm collar and seal water tight. Install chimney cap. NOTE: Refer to chimney manufacturer's specs. Chimney height, see figure 7. Minimum for mobile home is 9 1/2' above stove.
14. Install double-wall stove pipe connector from the stove to the chimney pipe, making sure to secure all joints of pipe together as well as the pipe to the stove flue collar with three sheet metal screws at each joint.
15. Call for final inspection.
16. INSTALL AND USE IN ACCORDANCE WITH THE MANUFACTURER'S INSTALLATION AND OPERATING INSTRUCTIONS ONLY.

YOUR STOVE IS NOW READY FOR USE. REFER TO OPERATING INSTRUCTIONS.

RESIDENTIAL INSTALLATION INSTRUCTIONS

Model: Kuma Wood Classic

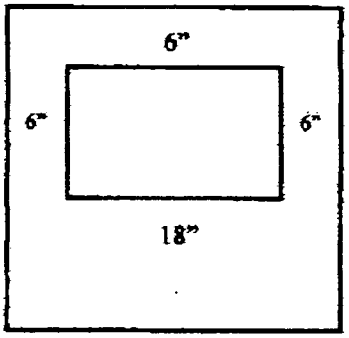
CAUTION– Always read instructions before beginning the installation.
Check all listed factory built chimneys for concealed damage.
Exercise caution to ensure that all necessary parts are installed correctly.

BEFORE YOU START ensure that there are no major obstructions (i.e. floor joists, ceiling joists, electrical wires, heat ducts, plumbing, etc.).

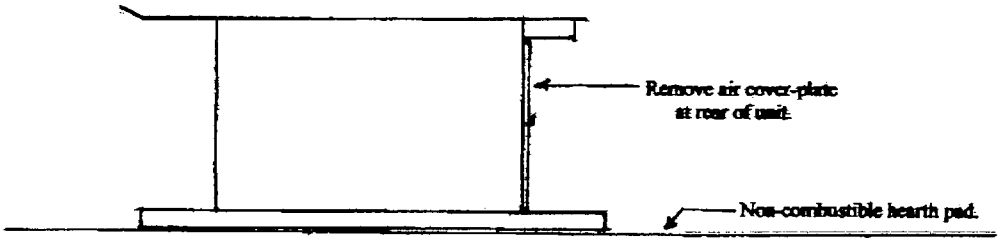
Clearance- See figures 3 through 6. Consult your local building official and build your hearth pad to local building requirements.

Use minimum 6" diameter black or "blued" steel chimney connector, 24 gauge minimum.

EXAMPLE: Typical hearth pad



NOTE: For residential installation, in which outside air intake is not desired, remove cover-plate at rear of pedestal base before installing stove as shown below. In this application, a hole through the floor is not required.



INSTALLATION

1. After locating possible obstructions (joists, pipes, etc.) and taking into account the necessary combustible clearances (fig. 2), position the stove in the intended installation position. Use a plumb line to locate the position of the ceiling hole for the chimney. Size the chimney hole to the recommended manufacturer's clearances for your chimney. Mark the hole.
2. If the ceiling is clear of all obstructions, cut out the hole (NOTE: Do not cut the ceiling trusses.)
3. In case of attic space use a plumb line to locate the hole in the roof. Cut out the opening, keeping in mind the chimney manufacturer's recommended clearances.
4. If outside air is desired, locate and cut a 5 or 6" diameter hole through the floor anywhere under the pedestal stove base. If air through the wall is preferred, a dryer-type vent pipe should be installed from the wall to the 3 1/2" diameter hole at the pedestal base back. A mesh-type screen should be installed to keep out rodents, etc.
5. Install a hearth pad according to local building codes or manufacturer's specs (see above figure).
6. Position the stove on the hearth.
7. Check all chimney pipe for damage. Do not use any damaged pipe. Installation procedures may vary from manufacturer to manufacturer of listed chimney. Install the rest of the chimney up through the hole in the ceiling and roof.
8. In cases when there is an attic space, install a protective joist shield tube or box. Consult local building officials or chimney manufacturer.
9. Install the roof flashing, sealing water tight. Install the storm collar and seal water tight. Install chimney cap. NOTE: Refer to chimney manufacturer's specs. Chimney height, see figure 7.
10. Install the stove pipe connector from the stove top to the chimney pipe, making sure to secure all joints of pipe together as well as the pipe to the stove flue collar with three sheet metal screws at each joint.
11. Call for final inspection.
12. Read completely the operating and burning instructions.

Your stove is ready to burn.

WOOD BURNING OPERATING INSTRUCTIONS

Model: Kuma Wood Classic

RECOMMENDATIONS ON BUILDING AND MAINTAINING A FIRE:

1. Open air control by pulling draft handle all the way out.
2. Start with tinder and small kindling. When starting a fire, stack wood in a "crisscross" arrangement so as to allow the fuel plenty of air. Place smaller chunks of wood, on up to larger ones until desired fire size and heat level is achieved. Once the desired heat level in house is reached, pushing the air control handle back in decreases the air to the firebox, and thus reduced heat produced. Use the following table as a general guideline for desired burn rates:

Low-burn-	Draft handle pushed all the way in.
Med-low-	Draft handle pulled out approximately 1/8".
Medium-	Draft handle pulled out approximately 1/4".
Med-high-	Draft handle pulled out approximately 1/2".
High burn-	Draft handle pulled all the way out.

CAUTION: When building the first couple of fires, be careful to build the fire small and increase heat slowly over a 4-5 hour period. The paint on the stove "cures" with heat and needs to be done slowly. As the paint "cures" it gives off a smell of paint, and even sometimes a visible "smoky" haze into the room. Make sure the area is well ventilated during the curing operation. The smell will disappear after a few hours of operation.

OPTIONAL BLOWER OPERATING INSTRUCTIONS: Install blower unit in back of stove as per instructions, and plug into nearest 115V grounded circuit. Turn the variable speed knob to 'click' onto high speed. As the knob is turned clock-wise, the blower speed decreases to your desired speed. The blower speed should match the desired burn rate on your stove: i.e. low-burn rate...low blower speed; high-burn rate... high blower speed and so forth.

DO NOT OPERATE THIS STOVE WITH THE DOOR OPEN. It may be necessary, however, to crack the door during the first 5 or 10 minutes during the start-up stage. Contact your dealer if you have any questions or problems building or maintaining a fire.

CAUTION: DO NOT USE CHEMICALS OR FLUIDS TO START OR FRESHEN UP A FIRE. DO NOT BURN GARBAGE OR FLAMMABLE FLUIDS SUCH AS GASOLINE, NAPHTHA, OR ENGINE OIL.

1. The unit is designed to burn wood only. Build the fire directly on the firebrick. Do not use grates. Your stove will burn better with about one inch of ash in the bottom. Your stove is a very efficient "airtight" heater and if you use high quality wood, there will be very little ash residue.
2. Use only the best grade of dry wood available. It takes a full year to properly dry your split wood, so plan ahead. Burning wet or green wood greatly increases the chance of creosote build-up and produces less heat. Store your fuel in a dry location and be sure to maintain clearances from the wood supply to your stove.
3. Small hot fires produce less creosote than long, low smoldering fires. When you start your stove, open the draft fully, and once or twice each day repeat this high burn cycle to reduce any creosote build-up. Just after starting the fire, some smoke may occur until the chimney warms up to produce some draft. During normal operation, adjust the draft to the position required. If properly set, it will assure longest burn times and the most even heat cycle.
4. Make routine inspections of your flue system at least once every two months to ensure clean, safe operation.
5. Ensure an adequate supply of outside combustion air is available. Failure to provide adequate combustion air is dangerous. Fifteen (15) square inches is recommended.

WOOD BURNING OPERATING INSTRUCTIONS (continued)

CREOSOTE FORMATION AND NEED FOR REMOVAL:

6. When wood is burned slowly, it produces tar and other organic vapors which combine with expelled moisture to form creosote. The creosote vapors condense in the relatively cool chimney flue of a slow burning fire. As a result, creosote residue accumulates on the flue lining. When ignited, this creosote makes an extremely hot fire. If creosote has accumulated, it should be removed to reduce the risk of a chimney fire.

DISPOSAL OF ASHES:

7. Ashes should be placed in a metal container with a tight-fitting lid. The closed container of ashes should be placed on a non-combustible floor on the ground, well away from all combustible materials, pending final disposal. If the ashes are disposed of by burial in soil or other wise locally dispersed, they should be retained in the closed container until all cinders have thoroughly cooled.

8. Maintain door seals, etc., to ensure airtight fit. Operate only with the fire door closed. Open door only to fuel fire.

9. Resist the temptation to refuel too soon. Let the fire burn down to just glowing coals before you open the door. This will be the most efficient operation and there will be less smoking. Do not overfire.

10. Contact your local or provincial fire authority for information on how to handle a chimney fire.

11. For further information on using your heater safely, obtain a copy of the National Fire Protection Association publication: "Using Coal and Wood Stoves Safely." NFPA No. HS-8-1974. The address of NFPA is: 470 Atlantic Ave., Boston, MA. 02210.

GLASS DOOR

1. Never clean hot glass.
2. Clean with an approved cleaner. Never use an abrasive.
3. Excessive mechanical stress will crack or break the glass. Should breakage occur see your dealer or carefully remove retainer screws to release glass. Dispose of broken glass in a safe place. Replace the glass only with 5mm neoceram available from your dealer. Always replace the gasket with a glass replacement. Check glass after heater has been fired to ensure a tight seal. Tighten retainer just enough to provide the airtight seal. Uneven pressure from over-tightened screws will break the ceramic (glass). See figure 1.
4. Never build the fire up against the glass.
5. When closing the door, do not allow logs to protrude against the glass.

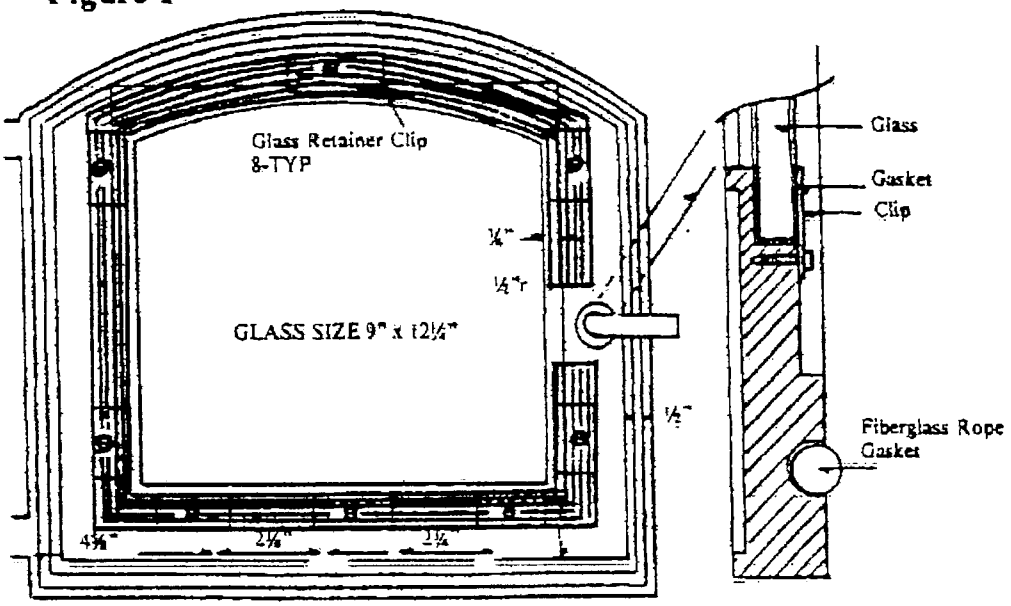
A WORD ABOUT DRAFT:

The principle of draft is that warm air rises. Your chimney provides draft which sucks the smoke up the chimney. The stove does not "push" out the smoke. Your Wood Classic stove has been designed and approved for use under normal conditions. Unacceptable smoking usually indicates poor draft in your chimney system. CHECK THAT YOU HAVE PROVIDED FOR ADEQUATE OUTSIDE AIR FOR COMBUSTION, IF APPLICABLE.

PROBABLE CAUSES FOR SMOKING ARE:

1. Insufficient chimney height above nearby obstructions.
2. Clogged or obstructed chimney system.
3. Downdrafts caused by nearby trees, hills, buildings, etc.

Figure 1



Typical Mobile
Home Installation

Figure 2

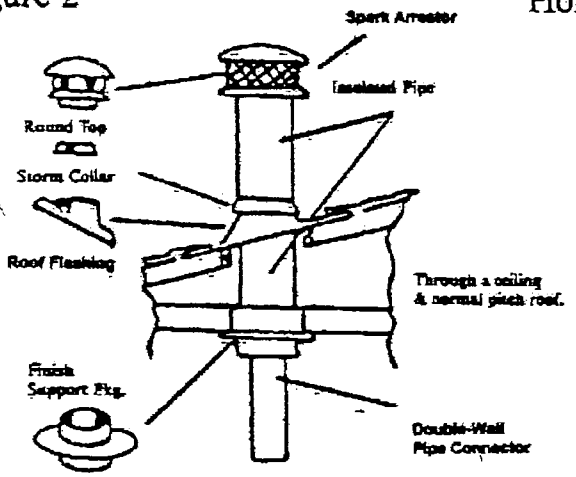


Figure 2B

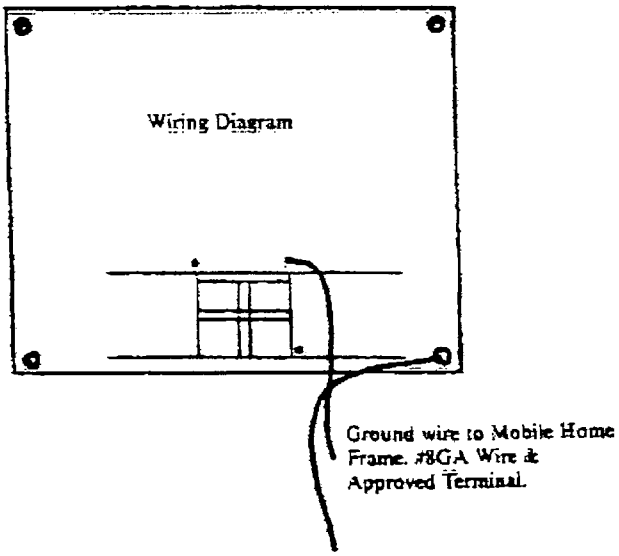
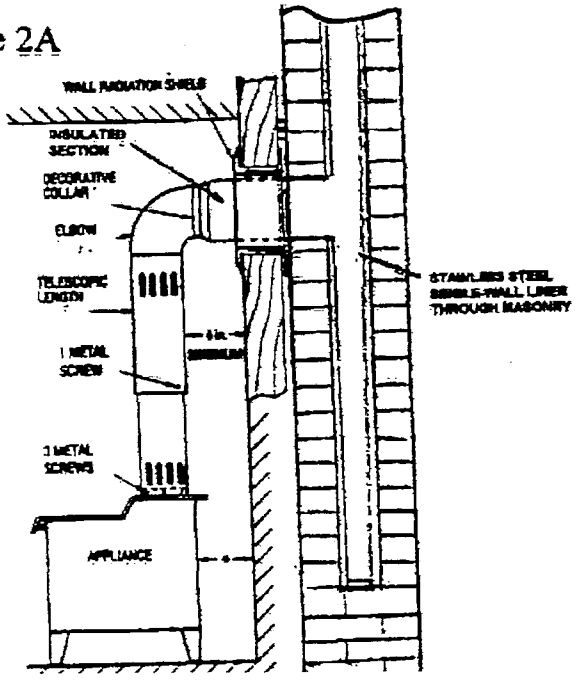
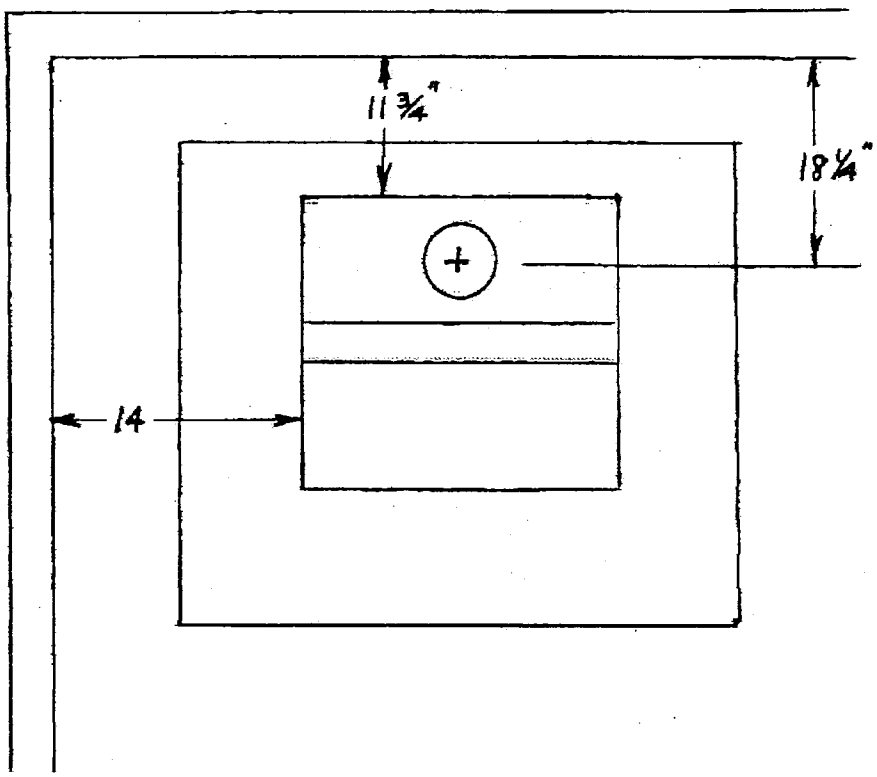


Figure 2A



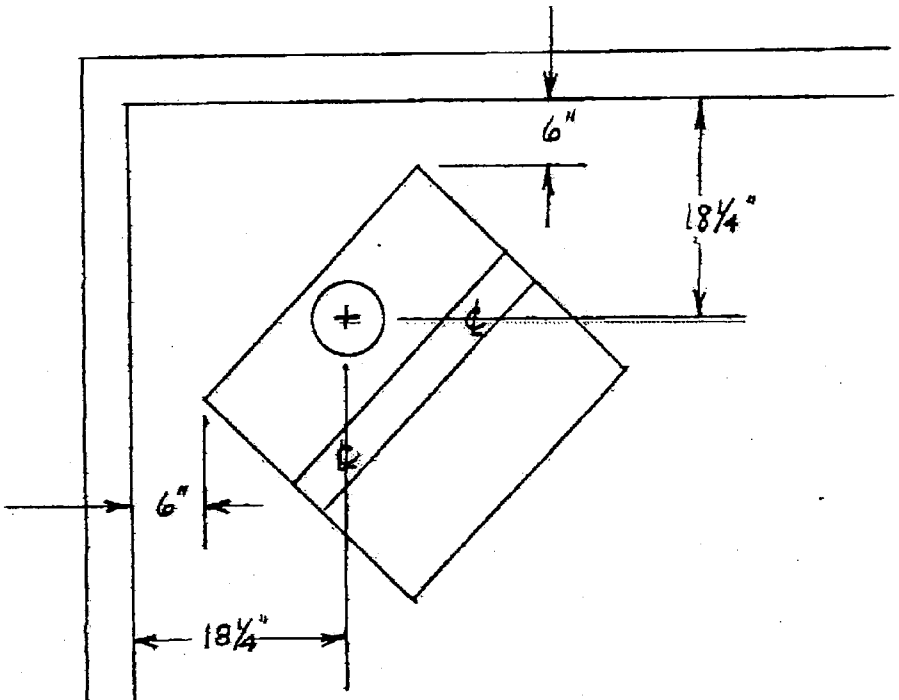
Use only 6" diameter Listed chimney system parts that have been tested and found to be compliant with all applicable U.L. standards. Clearances to combustibles must be maintained as per manufacturers instructions on chimney pipe, and stove pipe connectors. Use only double-wall connector in mobile home applications.

Figure 3



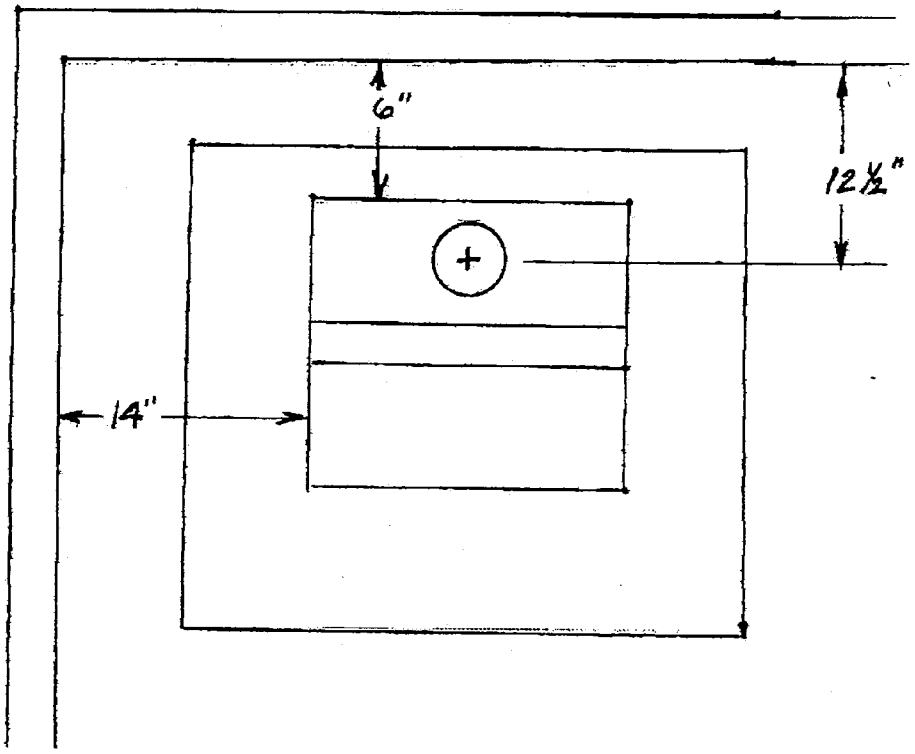
MINIMUM CLEARANCES TO COMBUSTIBLES– STRAIGHT WALL
CLASS C SINGLE-WALL CHIMNEY CONNECTOR

Figure 4



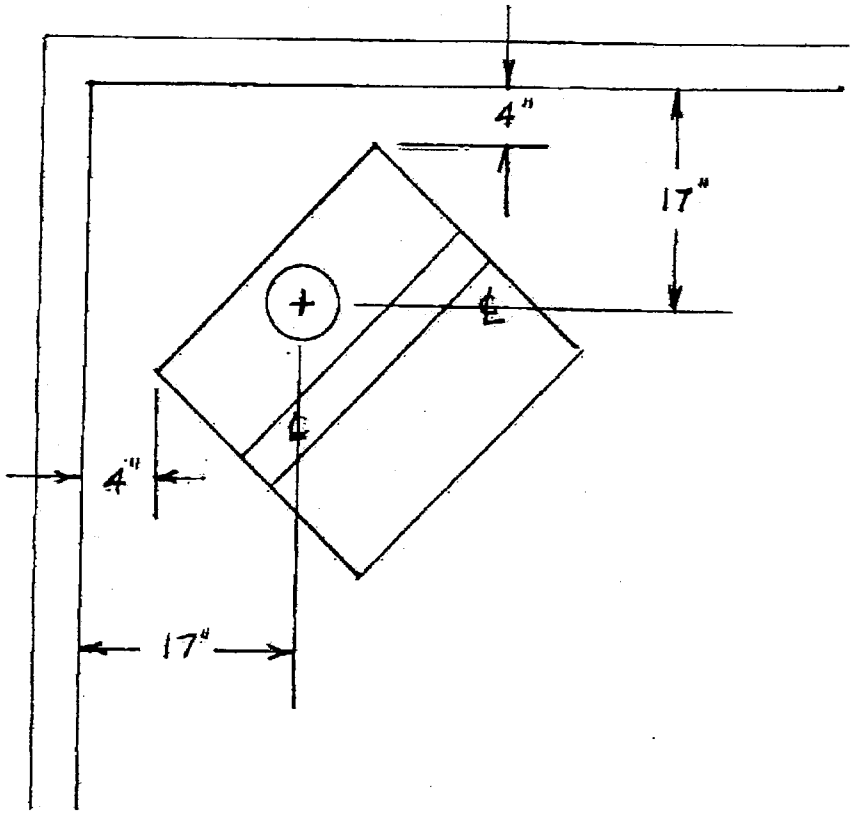
MINIMUM CLEARANCES TO COMBUSTIBLES– CORNER CLASS C SINGLE-WALL CHIMNEY CONNECTOR

Figure 5



MINIMUM CLEARANCES TO COMBUSTIBLE– STRAIGHT WALL
HT-TYPE LISTED CHIMNEYS USING APPROVED DOUBLE-WALL CONNECTOR

Figure 6

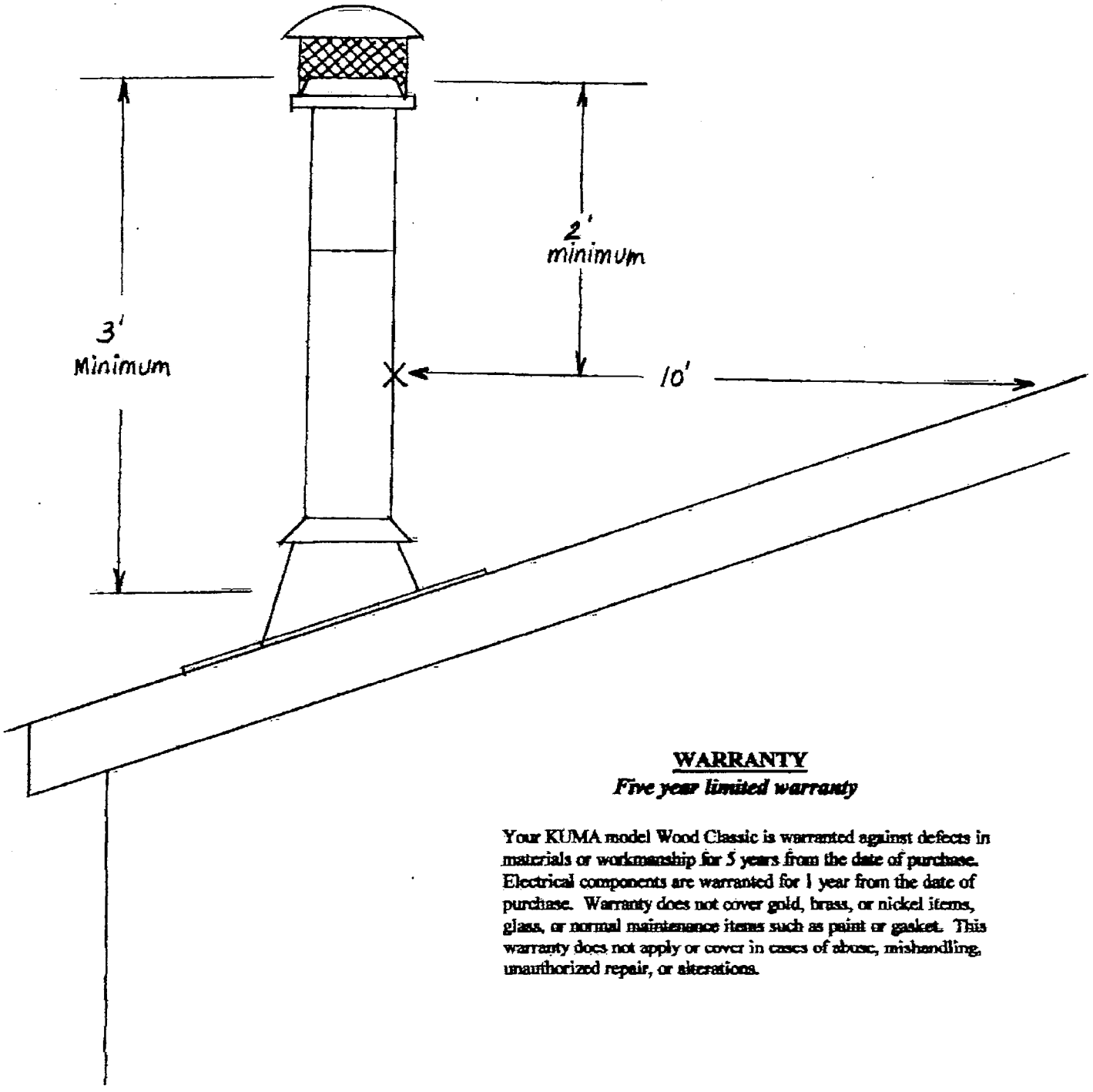


MINIMUM CLEARANCES TO COMBUSTIBLES– CORNER
HT-TYPE LISTED CHIMNEYS USING APPROVED DOUBLE-WALL CONNECTOR

HEIGHT REQUIREMENTS

A chimney must be the required height above the roof or other obstruction for safety and for proper draft operation. The requirement is that the chimney must be at least 3' higher than the highest point where it passes through the roof and at least 2' higher than the highest part of the roof or structure that is within 10' of the chimney, measured horizontally (figure 7).

Figure 7



WARRANTY

Five year limited warranty

Your KUMA model Wood Classic is warranted against defects in materials or workmanship for 5 years from the date of purchase. Electrical components are warranted for 1 year from the date of purchase. Warranty does not cover gold, brass, or nickel items, glass, or normal maintenance items such as paint or gasket. This warranty does not apply or cover in cases of abuse, mishandling, unauthorized repair, or alterations.

WOODSTOVE DATA SHEET # 30 stove storage4/99

STOVE STORAGE

The Kuma Wood Classic Noncatalytic Woodstove

tested by Myren Consulting, Inc. is being held in custody by

Kuma Stove and Iron Works and

is being stored at:

Kuma Stove and Iron Works
450 old Highway 95
Rathdrum, ID 83858

Contact person(s):
Mark Freeman

Phone:
(208) 762-8002

A. Temporary storage at Myren Consulting until certification is granted:

A single strap of steel banding is placed around the stove so that the banding crosses the door horizontally, making it impossible to open the door on the unit. If it is necessary to break the banding to check an internal dimension or component, the banding is immediately replaced after the work on the unit is completed. The unit is identified with its name written on a stove storage label that is taped to the window of the unit. (See next page for an example copy of a stove storage label.)

B. Permanent storage after certification has been granted:

The following measures have been taken to permanently seal the unit and prevent tampering. Several lengths of steel banding are placed around the stove in a manner that prevents the door from being opened. At least two of these lengths cross at 90° angles. At each 90° crossing point on the top of the stove and perhaps elsewhere, a Myren Consulting address label is placed over the crossing point. The lab manager then initials the label and it is then taped in place with 2" clear packing tape. The stove is then loaded onto a pallet and strapped to the pallet with several lengths of steel banding. A box - either cardboard, chipboard or plywood - is placed over the stove and attached to the pallet.

C. The sealed unit is identified as follows:

The name of the unit is written on a Myren Consulting address label which is affixed to the outside of the box. The top and sides of the box also have several stove storage labels affixed to it which clearly identify the unit as a test stove being stored pursuant to 40 CFR Part 60. These labels have the name of the stove clearly written on them. (A sample stove storage label follows on the next page.)

D. The unit was returned to the manufacturer via: Truck

WST5-Form11

W A R N I N G

SEALED EPA TEST STOVE

DO NOT OPEN OR TAMPER WITH THE SEALS AND PACKAGING ON THIS STOVE.

TO DO SO WILL VOID THE CERTIFICATION ON THIS STOVE.

Kuma Wood Classic

WST5-Form11

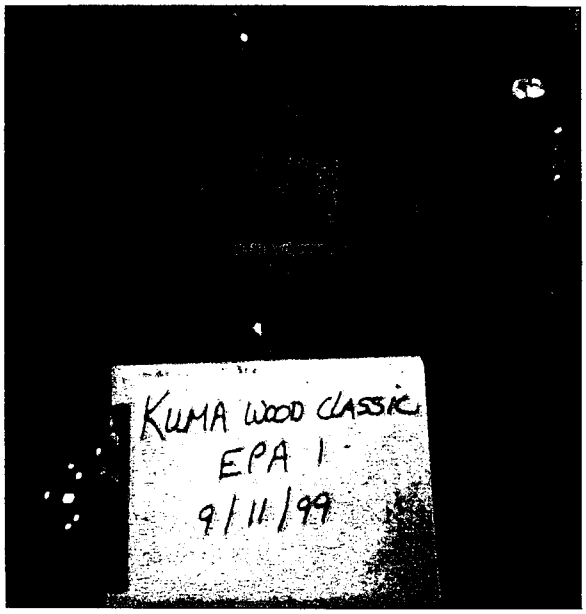
W A R N I N G

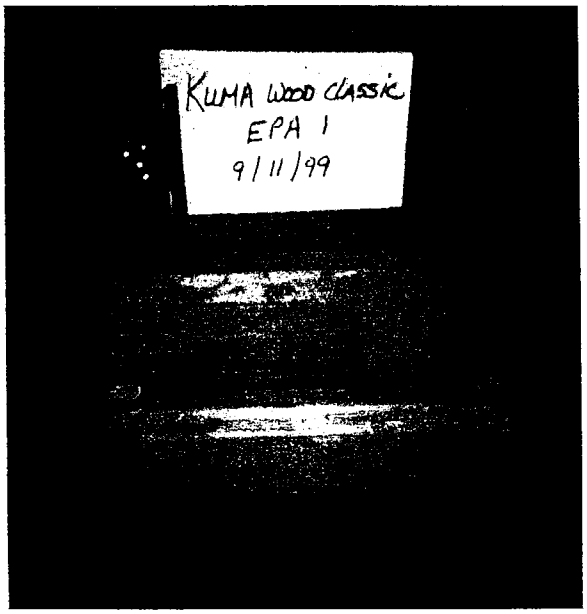
SEALED EPA TEST STOVE

DO NOT OPEN OR TAMPER WITH THE SEALS AND PACKAGING ON THIS STOVE.

TO DO SO WILL VOID THE CERTIFICATION ON THIS STOVE.

Kuma Wood Classic


KUMA WOOD CLASSIC
EPA 1
9/11/99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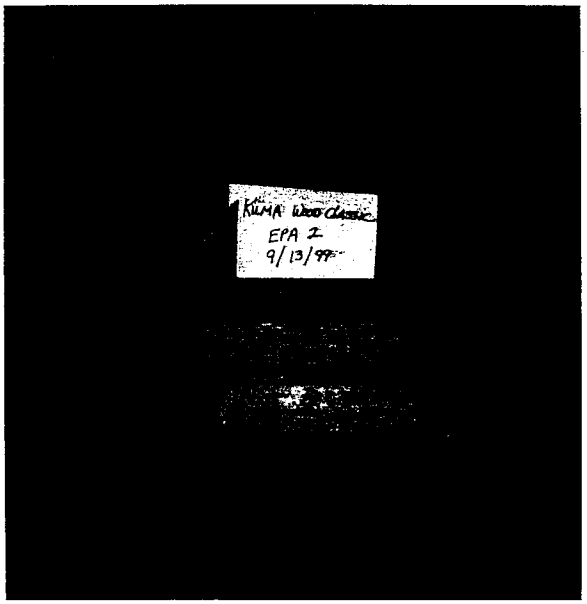
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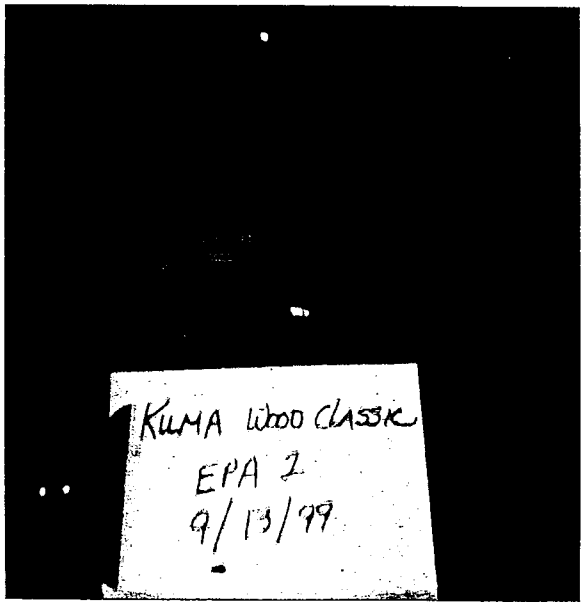
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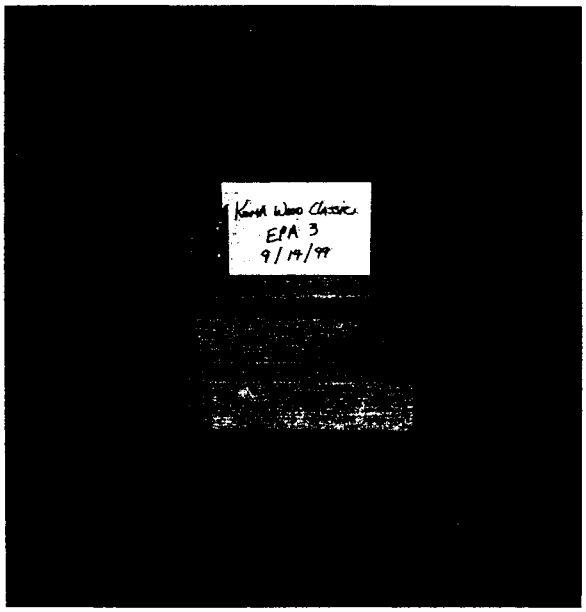
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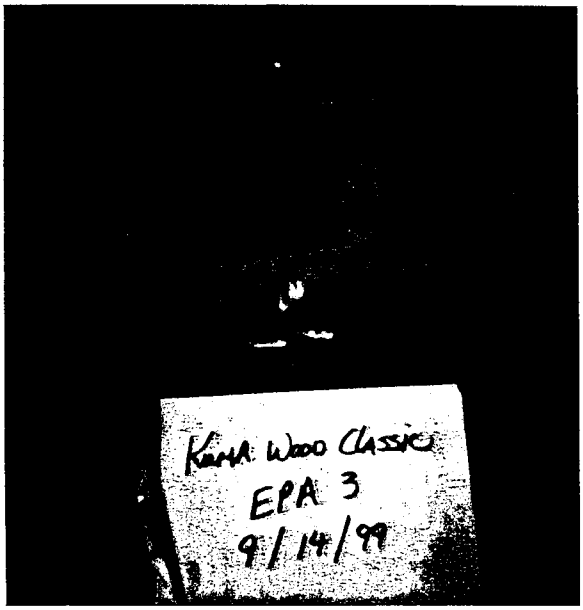
9/14/99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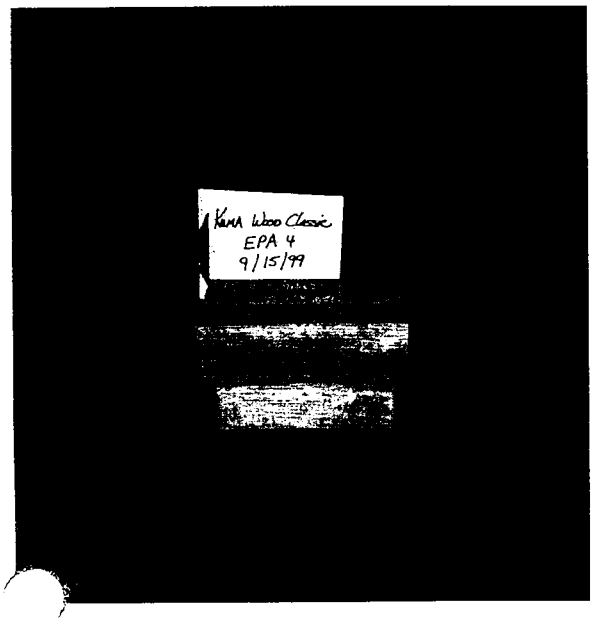
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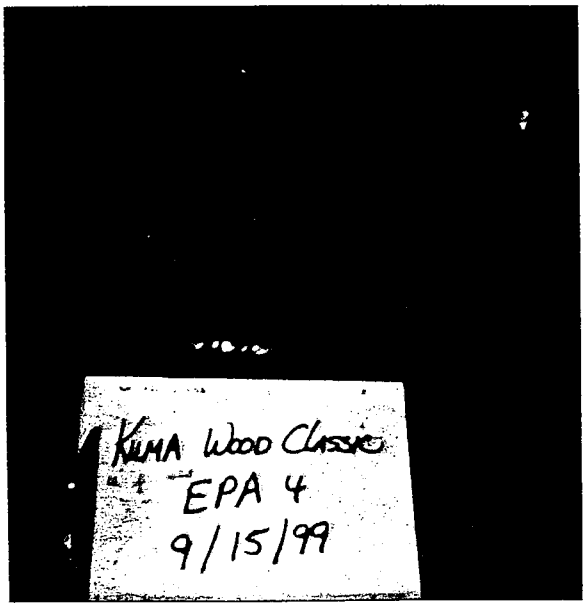
9/15/99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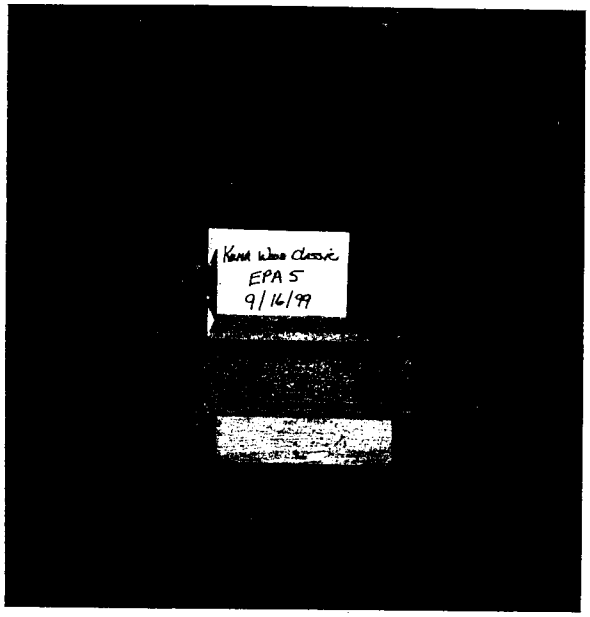
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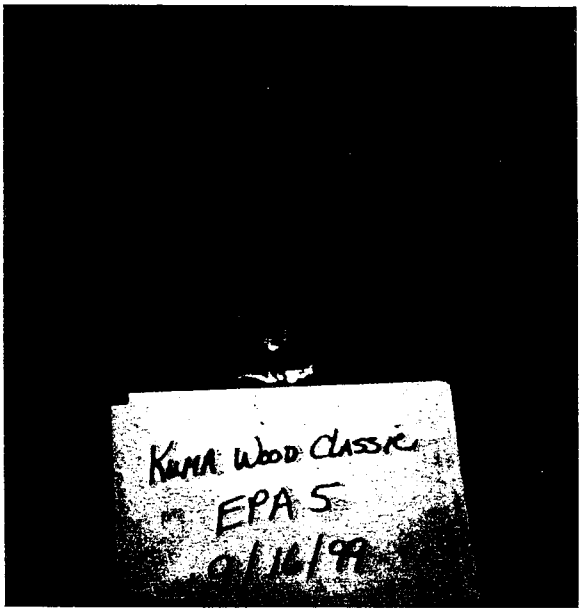
9/16/99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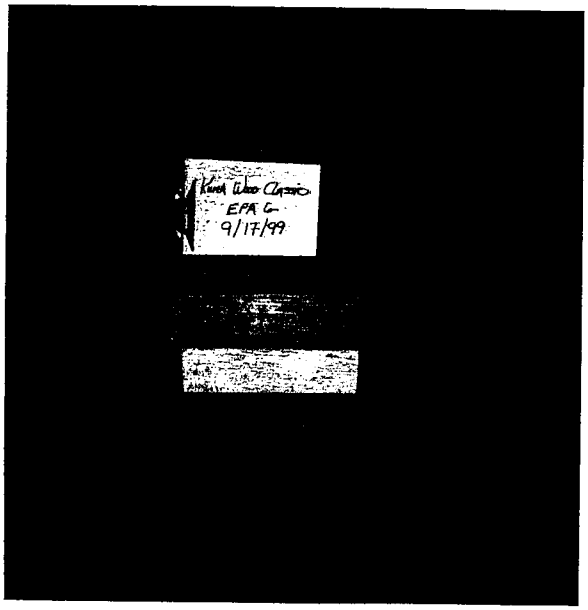
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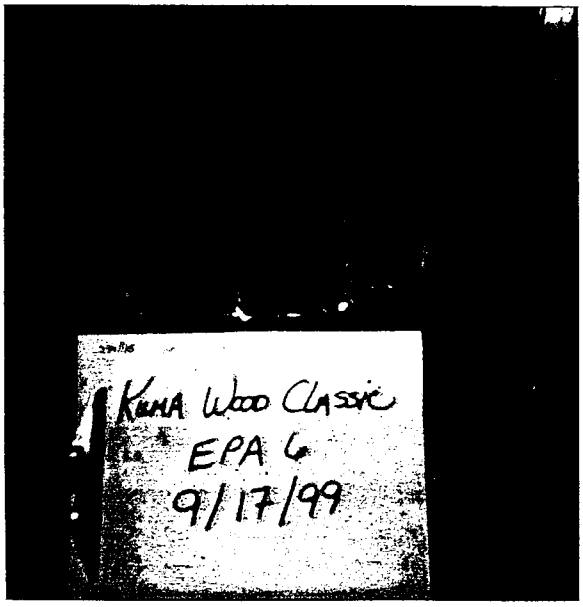
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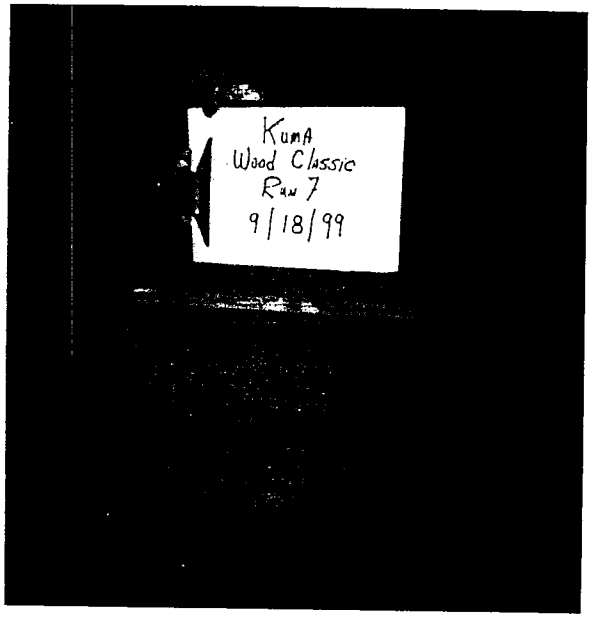
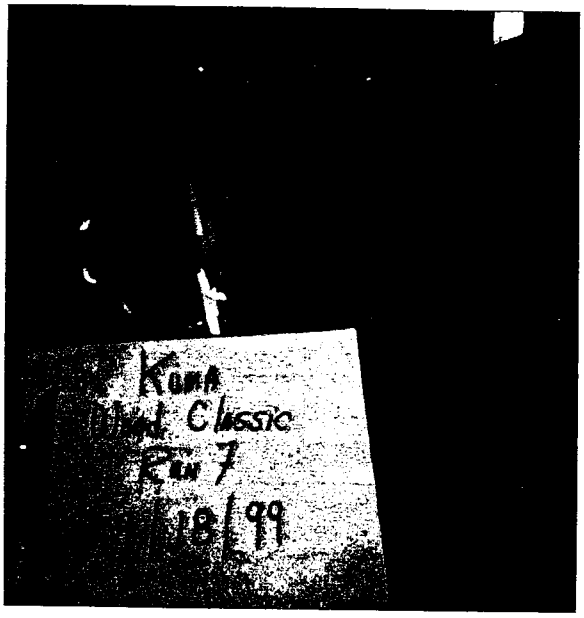

Kuma
Wood Classic
Run 7
9/18/99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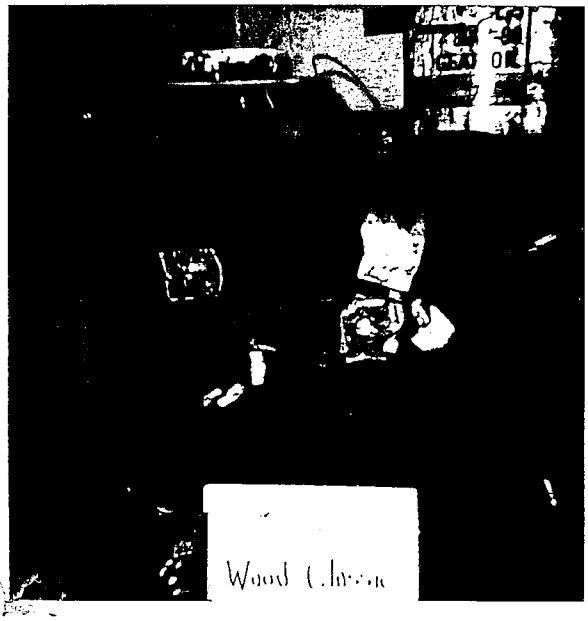
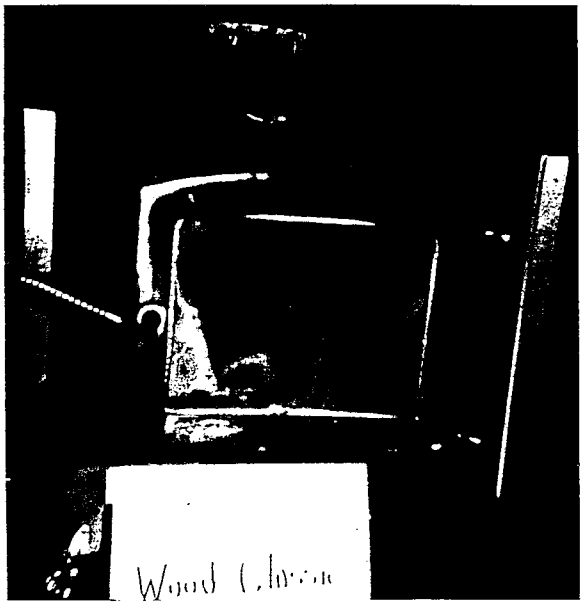

Wood Chipper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